THE EFFECTS OF BANNING DIRECT UNINVITED SOLICITATION ON PRICING, BIDDING, SEARCH AND SWITCHING DECISIONS IN THE MARKET FOR AUDIT SERVICES

By

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To my husband, Sam

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One area of concern regarding the structure of the market for auditing services is the restriction of the flow of information by solicitation bans within the profession. Currently, some state boards have ethical rules of conduct allowing direct uninvited solicitation while others ban it. The purpose of this dissertation is to model the effects of banning direct uninvited solicitation on prices, bidding, search and switching decisions in the market for audit services. These effects are analyzed from the perspective of the audit client, the current (incumbent) audit firm, and two entrant audit firms when direct uninvited solicitation is both allowed (the allowed market) and banned (the banned market).

The primary questions regarding direct uninvited solicitation of interest in this research include the following:

1. Do audit fees differ between the allowed and banned markets?
2. Do resources expended to produce audits differ between the allowed and banned markets?
3. Do audit firm profits and client costs differ between the allowed and banned markets?

This research contributes to the body of economic literature which examines the relationship between consumer knowledge of the prices of goods and the structure of markets for consumer goods. When the assumption of perfect consumer information is removed, theoretical and empirical research indicates that prices are higher. In contrast, results of this study indicate that this is not the case with bans on direct uninvited solicitation in the audit market. Conditions are derived in which fees, resource expenditures and audit firm profits are higher, lower or equal to fees in the allowed market.

CHAPTER 1
INTRODUCTION

In 1977, the U.S. Senate Subcommittee on Reports, Accounting and Management (Metcalf Committee) identified several areas of concern regarding the structure of the market for accounting services. One area of concern was the restriction of the "free flow of information" by bans on advertising and solicitation within the profession. Restricting these activities was viewed as detrimental to the public interest because users of accounting services were deprived of information needed to "properly evaluate the types, amounts, and prices of services offered by the accounting profession". The Metcalf Committee stated the following in its report:

> The public will receive the best accounting services in an environment which provides competition in pricing and innovation, but is balanced by a strong program to assure that professionalism and independence are not compromised. Accounting firms practicing in such an environment can inform the public of their abilities if the appropriate means become available.

The AICPA's Commission on Auditors' Responsibilities, the Cohen Commission (1978), has expressed concern regarding the profession's ability to create such a balance of professionalism and independence in a highly competitive environment. The Commission asserted that pressures to acquire or maintain audit clients have adversely impacted the quality of work performed by individuals auditing particular clients. Their report indicated that accounting firms have often cut costs to the point where the integrity of the independent audit is impaired. The primary mission of the accounting organization as envisioned by the Cohen Commission was to assure that professionalism and independence are not sacrified for commercial success.

The question of the legality of bans on advertising by professional groups was decided by the Supreme Court. In Virginia State Board of Pharmacy v. Virginia Citizens

Consumer Council, the Court held that bans on price advertising by pharmacists violated first amendment protection of commercial speech. Similarly, bans on advertising by attorneys were held to be unconstitutional in Bates v. State Bar of Arizona. Since 1978, the state boards of accountancy and the American Institute of Certified Public Accountants (AICPA) have removed bans on advertising as well as most of the restrictions on advertising activities other than those which convey "false, misleading, or deceptive messages".

In contrast to the Supreme Court's rulings on advertising, the Court held in Ohralik v. Ohio State Bar that first amendment protection does not extend to lawyers' bans on direct uninvited solicitation. The Court argued that direct uninvited solicitation leads to deception of consumers. Thus professional accounting groups, e.g., the AICPA, the National Association of State Boards of Accountancy (NASBA) and state boards of accountancy, are left to decide their own policies regarding direct uninvited solicitation. In response to the Justice Department's threat to file a complaint, the membership of the AICPA voted to allow direct uninvited solicitation. In recent years, the Justice Department also threatened action against several state boards of accountancy and filed a complaint against the Louisiana State Board of Accountancy, charging the Board with engaging in a combination and conspiracy in unreasonable restraint of interstate trade and commerce in violation of Section 1 of the Sherman Act. Nevertheless, some state boards have elected to retain their bans on direct uninvited solicitation. The majority of state boards banning direct uninvited solicitation adopt the rule of conduct pertaining to solicitation stated in the NASBA's Model Code of Professional Conduct. This rule states that "a licensee shall not solicit an engagement to perform professional services for a person or entity by any direct personal communication without the invitation of the person or entity". Direct uninvited solicitation is allowed if the person or entity is seeking professional services and has not engaged another to perform them.

Philip DeFliese, a past chairman of the AICPA board of directors, expressed support for bans on direct uninvited solicitation, arguing that the threat or loss of an engagement or the need to lower fees while the auditor is engaged in serving the client may consciously or subconsciously affect the independent attitude towards the management he is auditing and that an auditor's independence from clients suffers when clients are subjected to direct uninvited solicitation by other auditors. [1]

According to a study commissioned by the AICPA's Special Committee on Solicitation, AICPA members prefer bans on direct uninvited solicitation in the absence of "unfavorable publicity and legal action". The purpose of the study was to determine the opinions of members of the accounting profession regarding "how direct uninvited solicitation affects the public and the profession". The questions addressed to a sample of AICPA members covered the likely concerns of those opposing and supporting bans on direct uninvited solicitation. Questions covered the following three general areas: (i) the effects of direct uninvited solicitation bans on competition, (ii) the effects of direct uninvited solicitation on quality, independence and reputation, and (iii) the extent to which consumers are likely to be misled when accountants engage in direct uninvited solicitation.

Regarding competition, members do not believe that a prohibition of direct uninvited solicitation "lessens CPA competition". The argument of the Metcalf Committee that direct uninvited solicitation provides information which is useful to customers for evaluating the "types, amounts and prices of services offered by the accounting profession" is not supported. The profession does not believe that direct uninvited solicitation "makes the public more aware" or "helps the public make a better choice". Members also do not believe that prohibition of direct uninvited solicitation violates the CPA's freedom of speech. Members do, however, believe on average that direct uninvited solicitation has a somewhat negative effect on fees.

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[1] Letter, Philip L. DeFliese to State Board for Public Accountancy, the University of the State of New York (November 26, 1980).

Regarding the effects of direct uninvited solicitation on quality and independence, the profession does not believe that direct uninvited solicitation "lowers the quality of the CPA's services" or "impairs independence of CPAs". Thus, results of the survey indicate that the quality and independence concerns of DeFliese are not shared by the membership of the AICPA. Although members do not believe that the quality of the accounting service will be lowered by direct uninvited solicitation, members do expect the public to negatively perceive direct uninvited solicitation, i.e., the membership believes that the profession's reputation is harmed by allowing direct uninvited solicitation. For example, members believe that direct uninvited solicitation is "not professional", is "like ambulance chasing", "harms the CPA's image", "lowers the public's expectations of the quality of CPA services", "increases litigation against CPAs" and "increases government regulation of CPAs".

Regarding the protection of the consumer from deceptive information through direct uninvited solicitation bans, members believe that bans are ineffective in protecting clients from "fearful information" and "protecting against deceptive practices".

The purpose of this research is to theoretically examine the first category of concerns, i.e., the Justice Department and the Metcalf Committee's concerns over the competitive consequences of bans on direct uninvited solicitation. Models of the market in which direct uninvited solicitation is allowed (the allowed market) and the market in which direct uninvited solicitation is banned (the banned market) are derived and used to address the following questions:

1. Do audit fees differ between the allowed and banned markets?
2. Do resources expended to produce audits differ between the allowed and banned markets?

3. Do audit firm profits and client costs differ between the allowed and banned markets?

The second and third general areas of concern, the effects of direct uninvited solicitation on quality, independence and reputation and the extent to which consumers are likely to be misled when accountants engage in direct uninvited solicitation, are not addressed in this research. These topics are discussed in Chapter 2.

In this research, the assumption is made that audit quality is the same for all audit firms. Also, clients perceive audit quality to be homogeneous across audit firms. The assumption of homogeneous quality is a simplifying one and facilitates focusing the analysis on the stated research questions. Audit quality is defined to consist of two aspects related to the audit process. First, an audit firm expends effort to collect "sufficient, competent evidence as a basis for expressing an opinion on the financial statements taken as a whole". Second, the audit firm expresses an opinion. The "quality" of the opinion expressed depends both upon the quality of the evidence collected and upon the audit firm's ability to express an opinion independent of the wishes of client management. Costs incurred by audit firms to produce this uniform quality are not necessarily assumed to be equal. Although each firm is capable of collecting "sufficient competent evidence", audit production cost differences may exist. For example, geographic factors, differences in audit technology, and audit firm specialization within an industry may result in production cost differences across audit firms with respect to a specific client.

This paper models the market for auditing services under both the policies of banning and allowing direct uninvited solicitation. Given the homogeneity of audit quality, direct uninvited solicitation is defined to be a mechanism by which audit firms communicate fee information to potential clients. Addressing the above research questions entails modeling the pricing, bidding, information search and switching decisions of market participants under both the banned and the allowed markets. Effects of a solicitation ban on economic outcomes resulting from market participant decisions, e.g., audit fees, market participant profits and the amount of resources expended to provide auditing services to clients, are then determined. The audit market structures when direct uninvited solicitation is banned and allowed will frequently be referred to as the banned audit market structure (BAMS) and the allowed audit market structure (AAMS). Also, the banned audit market and the allowed audit market will frequently be referred to as BAM and AAM, respectively.

Derivation of the differences between outcomes for the BAMS and the AAMS requires modeling the economic decisions of three types of market participants. The participants include (i) the entity engaging an audit firm (the client), (ii) the audit firm currently retained by the client (the incumbent), and (iii) the audit firms seeking to render services to a potential client already served by the incumbent audit firm (the entrants).[2] The economic decisions modeled include the client's decision to search for audit fee information, the client's decision to switch audit firms, the incumbent audit firm's pricing decisions, entrant audit firms' bidding decisions and the client's decision to invite an entrant or entrants to bid when direct uninvited solicitation is banned. For simplicity of exposition, modeling assumes two entrants. Results are, however, generalizable to any number of entrants.

In addition to providing theoretical answers to the above research questions, this research provides a basis for the development of several empirically testable hypotheses regarding the relationship between fees and solicitation policy. Also the developed theory provides a basis for suggesting several other testable hypotheses. These hypotheses relate to differences in the role of advertising in the banned and allowed markets and differences in the frequency of switching between the banned and allowed markets.

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[2] In this paper, the term entrant is defined with respect to a particular client. The entrant may be a new accounting firm or an existing accounting firm within a market. The definition in the economic literature is usually broader to encompass a firm seeking to provide services to a market or aggregation of buyers not previously served by the seller.

This research contributes to the body of economic literature which examines the relationship between consumer knowledge of the prices of goods and the structure of markets for consumer goods. Direct uninvited solicitation is a mechanism by which entrant audit firms provide fee information to prospective clients. Economists have long recognized that strong informational assumptions are necessary for competitive equilibrium results in product markets.[3] When the assumption of perfect consumer information is removed, theoretical and empirical research indicates that prices are higher and more dispersed. Although a great deal of research exists related to this issue for product markets, very little research exists related to service markets, and none exists for the audit market.[4]

This paper is organized as follows. Chapter 2 reviews literature related to solicitation in the audit market and discusses the opinions of opponents and supporters of bans on direct uninvited solicitation. Chapter 3 describes assumptions made in formulating decision models in the banned and allowed audit markets and describes relationships between the decisions of market participants. Chapter 3 also describes fee, market participant cost, market participant profit and resource expenditure outcomes in terms of relevant costs, current and future fees and audit firm bids for all possible combinations of market participant decisions for the banned and the allowed markets. Audit firm bids, current fees and future fees are derived in Chapters 4 and 5 in terms of all relevant costs, e.g., audit firm production costs, audit firm bidding costs and non-fee client costs for all possible differences in the production costs (C_1^E, C_2^E and C^I) of audit firms. C^I, C_1^E and C_2^E are the production costs (excluding start-up costs) the incumbent, entrant 1 and entrant 2, respectively, would incur to provide the audit service to the client in each period $0,\ldots,\infty$. Chapter 5 also models the client's fee information search decision, the client's decision to invite one or more entrants to bid when direct uninvited solicitation is banned, the incumbent's fee-setting decision prior to client search and the incumbent's fee-setting decision prior to the client's invitation decision. Given fee, profit and resource expenditure outcomes derived in Chapters 4 and 5 for the BAM and the AAM, Chapter 6 presents the research results and suggests several testable hypotheses. The final chapter presents concluding remarks.

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[3] Previous work in product markets pertain to consumer ignorance of both the prices and the quality of goods. The earliest work in this area was by Stigler (1961). Other contributions and survey articles include Nelson (1970, 1974, 1978), Rothschild (1973), Rothschild and Stiglitz (1976), Salop (1976, 1977), Schmalensee (1978), Satterthwaite (1979), and Schwartz and Wilde (1979, 1982).

[4] Research regarding the effects of imperfect consumer information in service markets has examined the effects of advertising bans on the prices and quality of services. This research includes Benham (1972), Bond, Kwoka, Phelan and Whitten (1980), Cady (1976), and Muris and McChesney (1979).

CHAPTER 2
REVIEW OF RELEVANT LITERATURE AND OPINIONS REGARDING DIRECT UNINVITED SOLICITATION

In Chapter 1, three categories of potential effects of direct uninvited solicitation bans are described. These are (i) the effects of direct uninvited solicitation bans on competition, (ii) the effects of direct uninvited solicitation on quality, independence and reputation, and (iii) the extent to which consumers are likely to be misled when accountants engage in direct uninvited solicitation. These three categories are discussed in sections 2.1, 2.2 and 2.3, respectively. To date, no empirical or theoretical research has been done to study potential effects of bans on direct uninvited solicitation. Given the lack of research directly related to direct uninvited solicitation, the literature reviewed in this chapter consists of research that is tangentially of interest to the study of the effects of bans on direct uninvited solicitation.

2.1 Literature and Opinion Regarding the Effects of Direct Uninvited Solicitation on Competition

Those who oppose bans on direct uninvited solicitation argue that banning direct uninvited solicitation is anticompetitive and violates the antitrust laws. The United States Department of Justice is the most active opponent of bans on direct uninvited solicitation in the accounting profession. The reactions of professional accounting organizations and state boards to the investigative and legal actions taken by the Justice Department regarding this issue have been mixed. In 1978, the Justice Department threatened to file a complaint against the AICPA. The AICPA responded by authorizing a mail ballot asking the membership to vote for or against repealing the prohibition of direct uninvited solicitation. Some 68.7% of the membership voted to remove the ban on the direct uninvited solicitation of a specific potential client from rule 502 of the

AICPA's Code of Ethics.[1] Subsequent to the membership vote to repeal the prohibition of direct uninvited solicitation, the AICPA adopted a resolution to appoint a special committee to study the ramifications of the present status of the rules on direct uninvited solicitation and the legality of the rules. According to a survey commissioned by the AICPA's Special Committee on Solicitation, most members support bans on direct uninvited solicitation. The survey indicates that many members now believe that, if it was legal to do so, the AICPA should reverse the 1979 decision and reinstate the ban on direct uninvited solicitation. Opinions are shown to differ across firm size categories. Partners in small and medium-sized firms feel more strongly than partners in large firms that direct uninvited solicitation should be banned. One possible reason for this difference is that some small CPA firms desire the ban as a protection from the competition of large firms. Depositions of CPAs from small firms taken in connection with the Justice Department's case against the Louisiana State Board of Accountancy indicates that small firms are concerned that allowing direct uninvited solicitation gives large firms an opportunity to low ball (price below current costs) and take clients away. Despite the fact that the survey indicated membership support for reinstating bans on direct uninvited solicitation, the Special Committee on Solicitation recommended that bans on direct uninvited solicitation should not be reinstated by the AICPA. The committee states that this conclusion is based primarily on legal counsel and not on ethical grounds. The primary reason for this conclusion was that the Antitrust Division would, in all likelihood, institute an antitrust action challenging the ban. Legal counsel advised the Committee that the trend of case law and the absence of persuasive arguments in support of the ban make it unlikely that the ban would be upheld in a judicial proceeding.

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[1] This information was reported in the Report of the Special Committee on Solicitation prepared for the AICPA.

Some state boards continue to ban direct uninvited solicitation. The Justice Department threatened action against several state boards and filed a complaint against the Louisiana State Board of Accountancy in 1983. The board was charged with being engaged in a combination and conspiracy in unreasonable restraint of interstate trade and commerce in violation of section 1 of the Sherman Act. The Antitrust Division charged that this combination and conspiracy restrained competition among CPAs by unreasonably restricting advertising and solicitation. After the Antitrust Division began its investigations, the Louisiana board dropped its prohibition of direct uninvited written solicitations. The Louisiana board currently prohibits only direct uninvited oral solicitations. The board claims to have found that there is a potential for a variety of abusive, deceptive and injurious practices in oral uninvited solicitations, and expressed concern about it's ability to police such practices when records are unavailable.

The Senate Subcommittee on Reports, Accounting and Management (Metcalf Committee) also recommended the removal of artificial restrictions against talking with another firm's clients. The report states that the Subcommittee believes these restrictions have been detrimental to the public because they have prevented the free flow of information needed by users of accounting services to evaluate properly the types, amounts, and prices of services offered by the accounting profession. The Subcommittee concluded that these restrictions contributed to the dominance of the accounting industry by Big Eight firms.

Although there is no research studying the effects of direct uninvited solicitation bans on competition, some economists have examined the effects of advertising bans and advertising restrictions on prices and product quality in service markets. Advertising and direct uninvited solicitation can be viewed as either mechanisms for providing information to consumers and/or as methods of persuasion. Most of the economics literature related to advertising discounts the idea that advertising can be used to change the tastes of consumers or to mislead consumers, and views advertising strictly as a means of providing information to the consumer. A large body of literature has been developed in the last 20 years related to the economics of information. The general result of most of this work is that when information is costly, firms obtain market power, prices are above competitive levels and there is sometimes price dispersion. Stigler (1961) argues that price dispersion is the measure of consumer ignorance in markets. In a perfectly competitive market, price dispersion is impossible since perfectly informed consumers always purchase commodities from the lowest priced firm.

Literature regarding the competitive effects of advertising in professions focuses on the effects of advertising bans on prices and/or quality. There is no evidence that average quality differs between markets where advertising is restricted and markets where advertising is unrestricted. Professional groups have argued, by and large, that the quality of the professional service would suffer as a result of advertising due to the existence of information asymmetry in the market for professional services. Since consumers of professional services are generally unable to distinguish quality, professionals have an opportunity to lower quality without being detected. Professionals argue that when competition is increased by advertising, prices are forced downward and the suppliers of services lower service quality in an effort to maintain profits. Most economists discount the quality argument and view advertising restraints as mechanisms for maintaining excessive prices.

Empirical research has shown prices to be lower when advertising is allowed as compared to restricted in the professions. Benham (1972) compared the prices of eyeglasses for the following three categories: (i) states in which there were no advertising restrictions, (ii) states in which the advertisement of prices was restricted and (iii) states in which all advertisement was banned. He found prices were lowest for states in which there were no advertising restrictions and highest in states in which all advertisement was banned. Non-price advertising led to some price reduction as compared to no advertising.

The optometry profession is the subject of several studies on the relationship between advertising and prices and quality. An FTC study of advertising in the optometry profession [Bond, et al. (1980)] supports the view that advertising results in lower prices but does not support the view that advertising results in a lower quality of professional care. Average quality of eye examinations was not found to differ between restrictive and non-restrictive markets. Kwoka (1984) examined prices and the quality of services for the market for optometric services and found that prices and quality were lower for advertisers in non-restrictive markets, whereas nonadvertisers in non-restrictive markets provided higher quality at lower prices than nonadvertisers in restrictive markets. Average market quality for nonrestrictive markets was higher than average market quality for restrictive markets.

The Federal Trade Commission (FTC) also conducted a study of advertising by lawyers. In the legal profession, the FTC found that a positive continuous relationship exists between the restrictiveness of advertising and prices. Muris and McChesney (1979) examined advertising in the legal profession and found that advertising resulted in price reductions. Also, quality was found to improve with the advertising of legal clinics.

2.2 Literature and Opinion Regarding the Effects of Direct Uninvited Solicitation on Quality, Independence and Reputation

Philip DeFliese (past chairman of the AICPA board of directors) is one of the most vocal supporters of bans on direct uninvited solicitation. He states that the threat of the loss of an engagement or the need to lower fees while the auditor is engaged in serving the client may consciously or subconsciously affect the independent attitude towards the management he is auditing, and that an auditor's independence from clients

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suffers when clients are subjected to direct uninvited solicitation by other auditors.[2] The Cohen Commission asserted that pressures to acquire or maintain audit clients have adversely impacted the quality of work performed by individuals auditing particular clients. Their report indicated that accounting firms have often cut costs to the point where the integrity of the independent audit is impaired.

As discussed in Chapter 1, for convenience, audit quality is defined to consist of two aspects related to the audit process. First, an audit firm expends effort to collect "sufficient, competent evidence as a basis for expressing an opinion on the financial statements taken as a whole". Second, the audit firm expresses an opinion. The "quality" of the opinion expressed depends both upon the competence and sufficiency of the evidence collected and upon the audit firm's ability to express an opinion independent of the wishes of client management. Audit firms face a number of potential costs from lowering their audit quality by either a reduction of audit effort or a lowering of independence. These costs include a loss of reputation and losses incurred in litigation if audit failures occur. The question is whether or not bans on direct uninvited solicitation affect an auditor's decision regarding the amount of audit effort to expend or the type of audit report to issue. First of all, with regard to audit effort, the unobservability of audit inputs by the client creates potential for a lower quality of audit input. That is, the audit firm may seek to lower it's costs and achieve higher profits. Whether or not mechanisms such as peer review and the threat of litigation in the event of audit failure are sufficient to deter an audit firm from providing less than the contracted for amount of auditing is unknown. If we assume that these are not sufficient, the question is whether or not incentives to reduce audit effort are greater when direct uninvited solicitation is banned as compared to allowed. As the potential for reduction in audit effort arises from a lack of observability of audit inputs by the client, the question can be restated as follows. Does the client's ability to observe audit inputs differ between the banned and allowed markets? As direct uninvited solicitation is a mechanism by which audit firms provide information to clients, it would seem that there is little theoretical support for a reduction of audit effort by auditing firms in an environment where more information is available to clients.

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[2] Letter, Philip L. DeFliese to State Board for Public Accountancy, the University of the State of New York (November 26, 1980).

The issue of independence deals with the correspondence of the audit report that an audit firm issues to the facts discovered in the audit. Several points are worthy of observation. First, if an audit firm's decision is based solely on profitability, an audit firm issues an unqualified opinion in a situation where facts indicate a need for an opinion other than unqualified only if the expected cost of lowering independence is less than any perceived gains. That is, the expected cost of reputation losses and litigation costs must be less than the profits from retaining the client. Second, DeAngelo (1981) notes that independence is threatened by higher than normal rates of returns as opposed to lower or normal rates of return. Proponents of bans anticipate both lower independence and lower fees when direct uninvited solicitation is banned. DeAngelo developed an intertemporal audit pricing model which addressed the issue of whether "low balling" impairs auditor independence. Low balling is defined as setting audit fees below the total current costs on the initial audit engagement. She found that the practice of low balling has no effect on either (1) independence or (2) the magnitude of future audit fees as the initial fee reductions are sunk costs. Regulation aimed at eliminating the practice of low balling would actually increase the advantages to the incumbent auditors. DeAngelo suggests that efforts to increase the level of auditor independence should be aimed at reducing client-specific quasi-rents. Quasi-rents are the excess of future audit fees over the avoidable costs of producing audits, which are earned by incumbent auditors due to significant start-up costs and transaction costs related to changing auditors. Thus, the size of the contracting costs and start-up costs determine the size of specific client quasi-rents which an auditor can earn. Although assumptions used for modeling the audit market in this research differ from DeAngelo's, the existence of contracting costs and transaction costs results in the possibility of low balling and results in quasi-rents to the incumbent audit firm.

Schatzberg (1987) empirically tested the relationship between low balling and independence. His results also supported a lack of relationship between low balling and independence. Independence was found to be impaired when transaction costs exist in the audit market and there is some probability that sellers differ in quality. Both of these elements must be present in the market for independence to be impaired.

Simon and Francis (1988) empirically verified the existence of low ball bids, finding substantial audit fee discounts in the first three years of service subsequent to auditor switching. Their sample included 214 firms that switched audit firms during the period 1979-1984. They suggest that findings in the psychology literature point to the possibility that independence is impaired until audit fee discounts are recovered.

Several other studies theoretically examine the independence of auditors. Datar (1985), Antle (1984) and Watts and Zimmerman (1985) developed three person models consisting of the owner, manager and auditor. Similar to the above definition of independence, Watts and Zimmerman define auditor independence as the probability that an auditor reports a breach, conditional on a breach occurring.

Relating this discussion to bans on direct uninvited solicitation, both lower independence and lower fees are anticipated by some proponents of direct uninvited solicitation bans, possibly pointing to an inconsistency in their opinions regarding the effects of direct uninvited solicitation bans. Although future work is necessary to establish the relationship between bans on direct uninvited solicitation and audit effort or independence, this paper assumes that audit quality is uniform across audit firms.

2.3 Literature and Opinion Regarding Misleading Consumers With Direct Uninvited Solicitation

The last category of potential effects of direct uninvited solicitation bans deals with the possibility that consumers will be given misleading information. The Supreme

Court held in Ohralik v. Ohio State Bar that first amendment protection does not extend to bans of in-person solicitation by lawyers. The Court argued that solicitation leads to deception of consumers. According to McChesney (1985), the Court relied on anecdotal, testimonial evidence given to the FTC by state officials of instances in which consumers were deceived. McChesney also notes that the FTC has since collected statistical evidence, based on a random national sample of consumer experience with door to door solicitation, which indicates that very little deception exists and that consumers are very satisfied with their purchases. [3] McChesney, in his analysis of the inconsistency of legal findings regarding advertising and solicitation, states that "had the state truly had the burden of showing that deception via solicitation was a serious problem in Ohio, one wonders to what it would have pointed." McChesney concludes that "stated concerns about deception may mask predatory reasons for traditional restrictions on promotion."

Hite and Bellizzi (1986) conducted a study to determine consumers' attitudes towards advertising in the accounting, legal and medical professions. Results indicated a favorable attitude toward advertising. Results indicated that advertising by accountants is viewed more favorably than advertising by physicians.

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[3] See the 1981 study, Final Report of an Impact Evaluation of the Cooling-Off Period for Door-to-Door Trade Rule by the Public Sector Research Group.

CHAPTER 3
MODEL ASSUMPTIONS AND DESCRIPTION OF FEE, PROFIT AND RESOURCE EXPENDITURE OUTCOMES FOR DECISION COMBINATIONS

Comparison of the banned audit market structure to the allowed audit market structure requires formulation of models of market participants' decisions relevant to the determination of fees, market participants' profits and total resources expended by market participants related to the provision of the audit service to clients. Section 3.1 defines terms and section 3.2 describes assumptions made in formulating decision models. Section 3.3 provides a description of relevant relationships between the decisions of market participants and describes the set of possible combinations of market participant decisions given modeling assumptions. The decisions of market participants include entrant accounting firms' bidding decisions, the client's switching decision, the client's fee information search decision, and the incumbent accounting firm's pricing decisions. An example of a market participant decision combination is the occurrence of bidding by an entrant or entrants for a particular client followed by client switching. In addition, section 3.3 describes fee, market participant cost, market participant profit and resource expenditure outcomes for each combination of market participant decisions.

3.1 Definitions and Terms

The definition of terms used throughout the analysis are summarized below:

bidding costs: Bidding costs are costs incurred by accounting firms to provide specific potential clients with fee information.

invitation costs: Invitation costs are costs incurred by a client to invite entrants to bid when direct uninvited solicitation is banned.

search costs: Search costs are costs incurred by a client to learn the minimum bid of the entrant or entrants capable of providing the audit service at a cost less than other entrants.

switching costs: Switching costs include all costs incurred by the client as a result of switching accounting firms. These costs are incurred after the contracting process is complete and the client has selected a new accounting firm.

Symbolic representations of terms used throughout are defined as they are introduced. For convenience, an indexed key to symbols is provided in Appendix C.

3.2 Model Assumptions

Assumptions made in formulating decision models for the BAMS and the AAMS include the following:

- Bidding is modeled as an English auction. Bids in an English auction are offered in a sequential manner where sellers offer successively lower bids for an audit contract which is awarded to the lowest bidder. The market includes three audit firms, the incumbent, entrant 1 and entrant 2.

- The bidding decision of entrants is made under uncertainty regarding the production costs of the incumbent (C^I) and other entrants (C_i^E). Entrants do, however, have knowledge of their own production costs (C_i^E and S) associated with delivering the audit service for all periods, where terms are defined as follows:

  C_i^E ≡ entrant i's cost (excluding start-up costs incurred in period 0) of producing an audit in any period $0,\ldots,\infty$ where $i=1,2$, $C_1^E \leq C_2^E$ and C_i^E is stationary for periods $0,\ldots,\infty$ for all i.

  C^I ≡ the incumbent's cost of producing an audit in any period $0,\ldots,\infty$. Audit production costs for the incumbent (C^I) with respect to any client are assumed to be stationary over time.

  S ≡ client-specific start-up costs incurred by an accounting firm in the first year of auditing a client. Start-up costs are assumed to be constant across all accounting firms and stationary over time.

  Entrants are also assumed to have knowledge of the amounts of non-fee costs incurred by clients (SW, SC and I), where

  SW ≡ switching costs and includes all costs incurred by a client as a result of switching accounting firms. Switching costs do not vary across accounting firms and are stationary over time.

  SC ≡ search costs incurred by the client.

  I ≡ invitation costs incurred by the client to invite entrants to bid when direct uninvited solicitation is banned.

- The invitation and search decisions of clients in the banned audit market and the allowed audit market are made under uncertainty regarding the prices and production costs of audit firms other than the incumbent. The client does,

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however, have knowledge of bidding costs (G), start-up costs (S) and the discount rate (r) used by entrants to decide whether or not to bid and for calculation of the minimum bid entrant i is willing to offer in any period $0,...,\infty$ where terms are defined as follows:

G ≡ the cost accounting firms incur to engage in bidding. This cost is assumed to be constant across accounting firms and stationary over time.

r ≡ the discount rate used by accounting firms to determine the present value of future cash flows. This rate is assumed to be constant across accounting firms (entrants and the incumbent) and stationary over time.

- When entrants do not bid, clients can learn the minimum bid of entrant 1 by incurring search costs. Search costs (SC) are assumed to be constant and stationary over time.
- When entrants do not bid, the pricing decision of the incumbent in the banned audit market and the allowed audit market is made under uncertainty regarding the prices and production costs of entrant audit firms. The incumbent does, however, have knowledge of bidding costs (G), start-up costs (S) and the discount rate (r) used by entrants to decide whether or not to bid and to calculate the minimum bid entrant i is willing to offer in any period $0,...,\infty$. The incumbent is also assumed to have knowledge of the amounts of non-fee costs incurred by clients (SW, SC and I).
- In the event that the client switches to an entrant in period 0, the incumbent would incur start-up costs (S) in any subsequent period if the client switches back to the incumbent.
- Accounting firms offer only audit services.
- The client always demands the amount of auditing that satisfies the requirements of generally accepted auditing standards, and all accounting firms provide services which satisfy the requirements of generally accepted auditing standards. Thus, clients are indifferent to the identity of the accounting firm providing auditing services as long as the costs of hiring the accounting firms are identical.
- The client's cost of negotiating with entrants subsequent to receiving bids is assumed to be zero.
- All receipts and payments are assumed to be received or paid at the beginning of each period.
- Accounting firms adhere to their respective state board's ethical rules related to direct uninvited solicitation.
- Accounting firms do not collude.
- Clients are risk neutral and act to maximize expected utility, which is a function of profit.
- Accounting firms are risk neutral and act to maximize expected utility, which is a function of profit.

- Contracts between accounting firms and clients are one-period contracts.

The table below summarizes the knowledge (K) or lack of knowledge (U) which market participants have regarding production costs and other costs.

	Production Costs				Other Costs			
	C^I	C_1^E	C_2^E	S	SW	G	SC	I
Client	K	U	U	K	K	K	K	K
Incumbent	K	U	U	K	K	K	K	K
Entrant 1	U	K	U	K	K	K	K	K
Entrant 2	U	U	K	K	K	K	K	K

3.3 Relationships Between Decisions of Market Participants and Description of Fee, Profit and Resource Expenditure Outcomes for Decision Combinations

Figure 3-1 depicts the relationships between market participant decisions when direct uninvited solicitation is allowed and banned. The branches indicating that direct uninvited solicitation is allowed and banned are labeled A and $\bar{A}$, respectively. The upper portion of Figure 3-1 shows relationship between decisions of entrants, the client and the incumbent under the allowed audit market structure. When direct uninvited solicitation is allowed, the market participant decisions considered include

(i) the entrant bidding decision where branches are labeled as β and $\bar{\beta}$ where

$\beta \equiv$ bidding by one or more entrants and
$\bar{\beta} \equiv$ no bidding,

(ii) the client switching decision where branches are labeled as Δ and $\bar{\Delta}$ where

$\Delta \equiv$ the client's decision to switch and
$\bar{\Delta} \equiv$ no switching,

(iii) the incumbent fee setting decision prior to client search where branches are labeled as σ and $\bar{\sigma}$ where

$\sigma \equiv$ the incumbent's decision to set its fee such that the client's profit maximizing decision is to search and
$\bar{\sigma} \equiv$ the incumbent's decision to set its fee such that the client's profit maximizing decision is not to search.

Five decision combinations, labeled as A1 to A5, are possible. These decision combinations are discussed in greater detail in Sections 3.3.1 and 3.3.2 below.

The lower portion of Figure 3-1 shows relationship between decisions of entrants, the client and the incumbent under the banned audit market structure. When direct uninvited solicitation is banned, the market participant decisions considered include the above described decisions (i) through (iii) as well as

(iv) the incumbent's fee setting decision prior to client invitation with branches labeled as ι and $\bar{\iota}$ where

$\iota \equiv$ the incumbent's decision to set its fee such that the client's profit maximizing decision is to invite and
$\bar{\iota} \equiv$ the incumbent's decision to set its fee such that the client's profit maximizing decision is not to invite.

Six decision combinations, labeled as $\bar{A}1$ to $\bar{A}6$, are possible. These decision combinations are discussed in greater detail in Section 3.3.3 below.

3.3.1 Fee, Profit and Resource Expenditure Outcomes When Entrants Bid Assuming an AAMS: Decision Combinations A1 and A2

When direct uninvited solicitation is allowed, entrants may bid at any time. If entrants bid, decision combination A1 occurs when the client switches to an entrant auditing firm. Decision combination A2 occurs when the client retains the incumbent. As stated earlier, bidding in the market for audit services is modeled assuming an English auction framework. Bids in an English auction are offered in a sequential manner where sellers offer successively lower bids for an audit contract which is awarded to the lowest bidder. For example, assume a company not currently served by an auditing firm desires to hire an auditing firm to audit its financial statements. For this initial engagement, n auditing firms bid for the prospective client. The auditing firms offer homogeneous services, and the auditing firm offering the lowest bid is awarded the contract. If n auditing firms are willing to bid as low as $B_1^E, B_2^E, \ldots, B_n^E$ where $B_1^E \leq B_2^E \leq \ldots \leq B_n^E$, bidder 1 is awarded the contract. At a bid of B_2^E, bidder 2 refuses to lower its bid further and bidder 1 wins with a bid slightly below B_2^E. Thus, the amount of the winning bid depends upon bidder 2's valuation of the contract. The minimum bid of an audit firm is the bid that yields a normal return. Assuming that the maximum period of service is for one period, the minimum bids of entrant bidders equal the costs of producing the audit, i.e., $C_1^E + S$, $C_2^E + S$, ..., $C_n^E + S$, where $C_1^E \leq C_2^E \leq \ldots \leq C_n^E$. If $C_1^E < C_2^E$, the client hires entrant 1 and the audit fee is $C_2^E + S - \varepsilon$, where ε is a small amount.

This research, in contrast to a single period model, examines bidding by n auditing firms at the contract renewal date where n = 2, thus assuming the client has previously hired an auditing firm. The incumbent auditing firm is viewed along with the entrants as a bidder in the auction. [1] The audit market models described in this paper are thus complicated by three factors:

(1) The incumbent and entrants determine minimum bids considering current costs of producing the audit as well as future production costs and future fees.

(2) The incumbent audit firm's bidding position differs from the entrants in two respects:

  (a) A client incurs switching costs (SW) to switch from the incumbent to an entrant and does not incur switching costs to retain the incumbent.

  (b) The incumbent auditing firm does not incur start-up costs (S) in period 0, and entrants do incur start-up costs (S) to provide audit services to the client in period 0.

(3) When bidding occurs, the client selects an audit firm based upon bids in the current period, any future anticipated fees and switching costs.

For simplicity, the term incumbent hereafter refers to the auditing firm providing services to a client in the period prior to period 0, the bidding period under consideration. The term entrant refers to any other auditing firm, i.e., an auditing firm not providing services to a client in the period prior to period 0.

Let F_{min}^I be defined as the minimum bid of the incumbent in period 0 and define F^I as the incumbent's fee in periods 1,...,∞. The client's minimum cost of retaining the incumbent in period 0 and future periods is ($F^I_{min} + d_2 F^I$), the sum of the period 0 minimum bid (F^I_{min}) plus the discounted sum of fees in periods 1,...,∞ where

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[1] Determination of the winning auditing firm and the costs that clients incur to hire auditing firms in periods 0,...,∞ depends only upon the minimum bid relationships of bidder 1, 2 and the incumbent. The assumption of two entrant bidders is for convenience of exposition only. Extension of the analysis to more than 2 entrant bidders does not alter the results.

$$d_2 = \frac{1}{r}.$$

Let B^E_i be defined as the minimum bid of entrant i where i = 1,2 and define F^E_i as entrant i's fee in periods subsequent to switching. The client's minimum cost of switching to an entrant in period 0 and retaining the entrant in periods 1,...,∞ equals ($B^E_i + d_2 F^E_i + SW$), the sum of the period 0 fee, switching costs incurred in period 0 and the discounted fees in periods 1,...,∞. The possible relationships between the client's minimum cost of retaining the incumbent ($F^I_{min} + d_2 F^I$) and the client's minimum cost of switching to an entrant ($B^E_i + d_2 F^E_i + SW$) are described below. For simplicity, the case where the client is indifferent between retaining the incumbent and hiring an entrant is ignored.

$$B^E_1 + d_2 F^E_1 + SW < B^E_2 + d_2 F^E_2 + SW \le F^I_{min} + d_2 F^I \text{ or} \tag{3.1}$$

$$B^E_1 + d_2 F^E_1 + SW = B^E_2 + d_2 F^E_2 + SW < F^I_{min} + d_2 F^I \text{ or} \tag{3.2}$$

$$B^E_1 + d_2 F^E_1 + SW < F^I_{min} + d_2 F^I \le B^E_2 + d_2 F^E_2 + SW \text{ or} \tag{3.3}$$

$$F^I_{min} + d_2 F^I < B^E_1 + d_2 F^E_1 + SW \le B^E_2 + d_2 F^E_2 + SW \tag{3.4}$$

Note that the bidding positions described in (3.1)-(3.4) assume that the client hires an auditing firm in period 0 and retains the auditing firm in all subsequent periods 1,...,∞. This dominance of one audit firm over all others in periods 0,...,∞ follows from the assumed stationarity of costs for periods 0,...,∞.

Bid relationships (3.1) - (3.3) correspond to decision combinations A1, $\bar{A}1$, A5 and $\bar{A}5$. Bid relationship (3.4) corresponds to decision combinations A2, $\bar{A}2$, A4 and $\bar{A}4$. Sections 3.3.1.1 and 3.3.1.2 below describe fees, market participant costs and profits and resource expenditures in terms of minimum bids, future fees and relevant costs for decision combinations A1 and A2, respectively.

3.3.1.1 Decision combination A1

Decision combination A1 occurs when one or more entrants offer bids and the client switches to the entrant offering the lowest bid. This decision combination occurs when bid relationship (3.1), (3.2) or (3.3) holds. To maximize profits, the winning audit firm sets its bid at an amount such that the client's cost of hiring the winning audit firm is slightly less than the client's cost of hiring the winning audit firm's most powerful competitor. Let $B_1^{E^*}$ be defined as the maximum fee that the client is willing to pay entrant 1 in period 0 when entrant 1 is the winning audit firm. Entrant 1 sets its period 0 bid, $B_1^{E^*}$, such that $B_1^{E^*} + SW + d_2 F_1^E$ is slightly less than the client's minimum cost of switching to entrant 1's most powerful competitor. If, for example, minimum bids are ordered as in (3.1), entrant 1 sets its period 0 bid, $B_1^{E^*}$, such that $B_1^{E^*} + SW + d_2 F_1^E$ is slightly less than $B_2^E + SW + d_2 F_2^E$. Algebraic rearrangement yields

$$B_1^{E^*} = B_2^E + d_2 (F_2^E - F_1^E) - \varepsilon. \tag{3.5}$$

where ε is a small amount. If minimum bids are ordered as in (3.2), the client hires either bidder 1 or bidder 2 and the fee charged is

$$B_1^{E^*} = B_2^{E^*} = B_1^E = B_2^E. \tag{3.6}$$

Where minimum bids are ordered as in (3.3), entrant 1 sets its period 0 bid, $B_1^{E^*}$, such that $B_1^{E^*} + SW + d_2 F_1^E$ is slightly less than $F_{min}^I + d_2 F^I$. Algebraic rearrangement yields

$$B_1^{E^*} = F_{min}^I - SW + d_2 (F^I - F_1^E) - \varepsilon. \tag{3.7}$$

These period 0 fees for decision combination A1 as described in equations (3.5), (3.6) and (3.7) are summarized on row 1 of Table 3-1. Other market participant cost, market participant profit and resource expenditure outcomes are described on rows 2-12. The fee in periods $1,...,\infty$ and the sum of the period 0 fee and discounted future fees are described on rows 2 and 3, respectively. Rows 4a-4c summarize the resources expended by entrant 1 in the current and future periods. Row 4d describes bidding costs of entrants bidding for the client. Bidding costs equal nG where n = (1,2). As the client switches from the incumbent to an entrant, resource expenditures by the incumbent are zero (row 5) and the incumbent's profits in periods $0,...,\infty$ equal zero (row 12). Row 6 describes non-fee client costs for decision combination A1, and row 7 summarizes total discounted fee and non-fee client costs for periods $0,...,\infty$. Row 8 describes resource expenditures for periods $0,...,\infty$. Finally, rows 9-12 describe entrant and incumbent profit outcomes for decision combination A1.

3.3.1.2 Decision combination A2

Decision combination A2 occurs when one or more entrants offer bids and the client retains the incumbent audit firm. This decision combination occurs when bid relationship (3.4) holds where

$$F^I_{min} + d_2 F^I < B^E_1 + d_2 F^E_1 + SW \leq B^E_2 + d_2 F^E_2 + SW.$$

Let F^{I^*} represent the maximum fee that the client is willing to pay the incumbent in period 0 when the incumbent is the winning audit firm. The incumbent sets its period 0 bid F^{I^*} such that $F^{I^*} + d_2 F^I$ is slightly less than $B^E_1 + d_2 F^E_1 + SW$, i.e.,

$$F^{I^*} = B^E_1 + SW + d_2(F^E_1 - F^I) - \varepsilon. \qquad (3.8)$$

Fees for decision combination A2 are summarized on Table 3-2 along with market participant cost, market participant profit and resource expenditure outcomes.

3.3.2 Fee, Profit and Resource Expenditure Outcomes When Entrants Do Not Bid Assuming an AAMS: Decision Combinations A3 - A5

When entrants offer bids, the client switches or the bidding process effectively places an upper limit of $B^E_1 + SW + d_2(F^E_1 - F^I) - \varepsilon$ [equation 3.8] on the fee of the incumbent auditing firm. When bids are not offered by entrants, some mechanism must exist to place a reasonable upper limit on the incumbent's fee. It is reasonable to expect that the client will search for entrant fee information if the client believes the incumbent's fee is high relative to the minimum bid a client believes it could receive from an entrant. The client has several potential means of obtaining entrant bid information with which to negotiate a lower fee with the incumbent auditing firm. First, the client may estimate the minimum bid and future fee of the entrant capable of providing the audit service at minimum cost by approaching clients of prospective entrants and soliciting information regarding fees charged by entrant auditing firms. Alternatively, the client could learn an entrant's fees by compensating the entrant for its bidding cost (G), making it costless for the entrant to bid. Regardless of the method, this research assumes that the client can learn the minimum entrant bid (B_1^E) and future fee (F_1^E) by incurring search costs. Either decision combination A4 or A5 (Figure 3-1) occur if the client searches for bid information. Tables 3-4 and 3-5 describe fee, market participant cost, market participant profit and resource expenditure outcomes for decision combinations A4 and A5, respectively. These decision combinations are identical to outcomes for decision combinations A1 and A2 with the exception that the client incurs search costs and entrants do not incur bidding costs. This affects resources expended by entrants (row 5), non-fee client costs (row 6), the discounted sum of client costs in periods $0,\ldots,\infty$ (row 7), the discounted sum of total resources expended in periods $0,\ldots,\infty$ (row 8) and entrant 1's profits in period 0 (row 12).

Decision combination A3 occurs when entrants do not bid and the client does not search. In deciding whether or not to search, the client assesses the value of entrant fee information in terms of discounted expected differences in audit-related costs for periods $0,\ldots,\infty$ between the alternatives of searching and not searching. Audit-related costs include fees and any non-fee costs the client may incur, i.e., search costs (SC) and switching costs (SW). When the client decides to search, the client believes that the total discounted cost of retaining the incumbent at the incumbent's current fee is high relative to the discounted cost the client would incur subsequent to search. If the client searches, the client either switches to the entrant if $B_1^E + d_2F_1^E + SW < F_{min}^I + d_2 F^I$ (decision combination A5) or negotiates a fee equal to $F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon$ while retaining the services of the incumbent if $F_{min}^I + d_2 F^I < B_1^E + d_2F_1^E + SW$.

As the client compares the incumbent's current fee to expected audit costs given search, the pricing behavior of the incumbent auditing firm can affect a client's search behavior. This occurs in the following manner. An incumbent auditing firm determines

> (a) the maximum fee which results in a decision by the client not to search for audit fee information [the no-search fee ($F^I_{\bar{\sigma}A}$)] based upon the client's beliefs regarding fees subsequent to search, and
>
> (b) its expectation of the maximum fee it can charge when the client searches for fee information, i.e., the expected fee given client search [$E(F^{I^*})$].

If the discounted sum of the incumbent's profit in periods 0,...,∞ given no search ($\pi^I_{\bar{\sigma}A}$) exceeds the incumbent's expected profit given search [$E(\pi^I_{\sigma A})$], the incumbent auditing firm charges $F^I_{\bar{\sigma}A}$, a fee which is expected to prevent the client from searching for audit fee information. The incumbent auditing firm's assessment of client beliefs regarding the minimum bid of entrant 1, B_1^E, and future fee of entrant 1, F_1^E, form the basis for the incumbent's estimate of the no-search fee ($F^I_{\bar{\sigma}A}$). The incumbent auditing firm's own beliefs regarding the minimum bid and future fee of entrant 1 form the basis for the incumbent's estimate of the fee the incumbent expects to charge if the client searches [$E(F^{I^*})$]. Table 3-3 describes fees, market participant cost, market participant profit and resource expenditure information for decision combination A3.

3.3.3 Fee, Profit and Resource Expenditure Outcomes When Entrants Bid Assuming a BAMS

When direct uninvited solicitation is banned, entrants are prohibited from offering bids unless invited by the client. The invitation of entrants is assumed to be costly. The client's decision to invite entrants to bid depends upon its beliefs regarding the relationships between the current and future fees of entrants and the incumbent.

3.3.3.1 Fee, profit and resource expenditure outcomes when the client invites bidding: decision combinations $\bar{A}1$ - $\bar{A}5$

The invitation decision is similar to the client's search decision. If the client decides to invite bidding, the client believes that the cost of retaining the incumbent at the incumbent's current fee is high relative to audit related costs the client would incur if the client invites. If the client incurs invitation costs (I) and invites entrants to bid, the sequence of entrant, incumbent and client decisions is shown in Figure 3-1 to be identical to the case where direct uninvited solicitation is allowed. The following five decision combinations ($\bar{A}1$ to $\bar{A}5$) are possible:

(i) An entrant or entrants bid and switching occurs (decision combination $\bar{A}1$).

(ii) An entrant or entrants bid and switching does not occur (decision combination $\bar{A}2$).

(iii) Bids are not offered and the client chooses not to search (decision combination $\bar{A}3$).

(iv) Bids are not offered and the client searches but does not switch (decision combination $\bar{A}4$).

(v) Bids are not offered and the client searches and switches (decision combination $\bar{A}5$).

Fees, market participant costs, market participant profits and resource expenditures for decision combinations $\bar{A}1$ - $\bar{A}5$ are summarized on Tables 3-6 through 3-10, respectively.

3.3.3.2 Fee, profit and resource expenditure outcomes when the client does not invite bidding: decision combination $\bar{A}6$

If the client does not invite entrants to bid, the decision combination is $\bar{A}6$. As the client compares the incumbent's current fee to expected audit costs given invitation, the incumbent auditing firm is in a position to influence the invitation decision of the client. If the incumbent sets fees low enough to result in a no-invitation decision,

decision combination $\bar{A}6$ occurs. The incumbent determines the maximum fee which results in a no-invitation decision [the no-invitation fee ($F^{I}_{\bar{\iota}}$)] and estimates the fee it can charge if the client invites entrants to bid [$E(F^{I}_{\iota})$]. If the incumbent's profit given no invitation ($\pi^{I}_{\bar{\iota}}$) exceeds the incumbent's expected profit given invitation [$E(\pi^{I}_{\iota})$], the incumbent auditing firm charges the no-invitation fee ($F^{I}_{\bar{\iota}}$). Fee, market participant cost, market participant profit and resource expenditure outcomes for decision combination $\bar{A}6$ are summarized on Table 3-11.

This research assumes that the client and the incumbent have equal access to information regarding the minimum bids of entrants and assumes that the incumbent and client have identical beliefs regarding the unknown production costs of entrants. This is a simplifying assumption to reduce the number of possible comparisons between outcomes for the BAMS and the AAMS. Given this, the incumbent knows the no-search fee, $F^{I}_{\bar{\sigma}A}$, and the no-invitation fee, $F^{I}_{\bar{\iota}}$.

3.4 Summary of Chapter 3 and Additional Work Required for Policy Comparisons

Chapter 3 outlines the eleven possible decision combinations of market participant bidding, switching, search, invitation and incumbent fee-setting decisions. Tables 3-1 through 3-11 describe fees, market participant costs, profits and resource expenditures for each decision combination in terms of minimum bids, future fees and assumed costs.

Fee, market participant cost, market participant profit and resource expenditure outcomes for decision combinations A1-A11 are seen in the above discussions to depend upon the bid relationships of entrant 1, entrant 2 and the incumbent. When the number of entrants (n) exceeds 2, the remaining n-2 entrants affect outcomes only in terms of bidding costs incurred for outcomes A1, A2, $\bar{A}1$ and $\bar{A}2$, i.e., if n entrants bid under the BAMS or the AAMS, total resources expended are increased by nG. The fees in periods 0,...,∞ depend solely upon the bid relationships between entrant 1, entrant 2 and the incumbent.

This research seeks to compare the AAMS and the BAMS across all possible differences in the production costs of entrant 1, entrant 2 and the incumbent. Comparison of the AAMS and the BAMS requires derivation of B_1^E, B_2^E, F_{min}^I, F_1^E, F_2^E, F^I, B_1^{E*}, F^{I*}, $F_{\bar{\sigma}A}^I$, $F_{\bar{\sigma}\bar{A}}^I$ and $F_{\bar{\iota}}^I$ for all possible differences between C_1^E, C_2^E and C^I. Derivations of B_1^E, B_2^E, F_{min}^I, F_1^E, F_2^E, F^I, B_1^{E*}, F^{I*} are described in Chapter 4. Chapter 5 describes the client's search decision, the incumbent's fee-setting decision prior to search, the client's invitation decision and the incumbent's fee-setting decision prior to invitation. Modeling these decisions yields

(a) the no-search fee under the AAMS, $F_{\bar{\sigma}A}^I$,

(b) the no-search fee under the BAMS, $F_{\bar{\sigma}\bar{A}}^I$ and

(c) the no-invitation fee, $F_{\bar{\iota}}^I$.

In Chapter 6, fee, market participant cost, market participant profit and resource expenditure outcomes for decision combinations A1-A5 and $\bar{A}1$ - $\bar{A}6$, as described in Tables 3-1 through 3-11, are restated in terms of the derived values of B_1^E, B_2^E, F_{min}^I, F_1^E, F_2^E, F^I, B_1^{E*}, F^{I*}, $F_{\bar{\sigma}A}^I$, $F_{\bar{\sigma}\bar{A}}^I$ and $F_{\bar{\iota}}^I$ for all possible differences in the costs of entrant 1, entrant 2 and the incumbent. Comparisons are then made between fee, market participant cost, market participant profit and resource expenditure outcomes of the banned audit market structure and the allowed audit market structure for all possible decision combinations and cost differences. Chapter 6 also describes conditions necessary for each comparison.

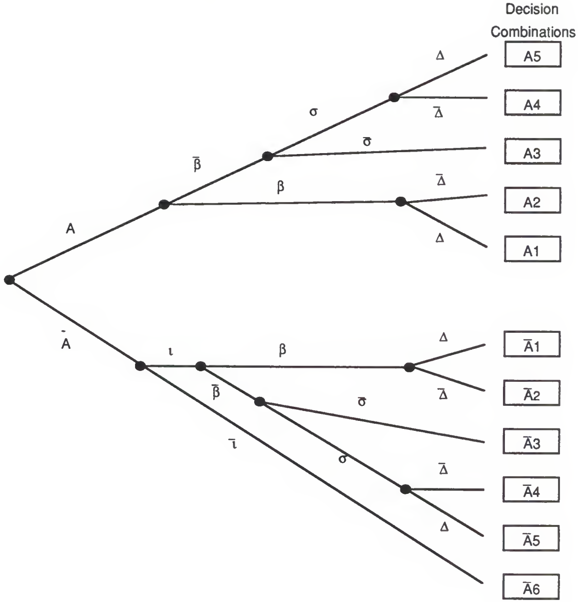


Figure 3-1
The Flow of Decisions in the AAMS and BAMS

Table 3-1
Fees, Profits and Resource Expenditures for Decision Combination A1(β, Δ)

1	Period 0 Fee	$B_1^{E*} = B_2^E + d_2\,(F_2^E - F_1^E) - \varepsilon$ or (3.5) $B_1^{E*} = B_1^E = B_2^E$ or (3.6) $B_1^{E*} = F_{min}^I - SW + d_2(F^I - F_1^E) - \varepsilon$ (3.7)
2	Fee in Periods 1,...,∞	F_1^E
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E$
4	Resources Expended By Entrants:	
	a. Production Costs in Period 0	$C_1^E + S$
	b. Production Costs in Each Period 1,...,∞	C_1^E
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
	d. Other Period 0 Costs	nG
5	Resources Expended By Incumbent	None
6	Non-Fee Client Costs	SW
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + d_2F_1^E$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + nG$
9	Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G$
10	Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F_1^E - C_1^E)$
11	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E)$
12	Incumbent's Profits in Periods 0,...,∞	None

Table 3-2
Fees, Profits and Resource Expenditures for Decision Combination A2 $(\beta, \overline{\Delta})$

1	Period 0 Fee	$F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon$ (3.8)
2	Fee in Periods 1,...,∞	F^I
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2(2)]$	$F^{I^*} + d_2F^I$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ $(4a + d_2 4b)$	d_1C^I
5	Resources Expended By Entrants	nG
6	Non-Fee Client Costs	None
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + d_2F^I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + nG$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I^*} - C^I$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F^I - C^I)$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I)$
12	Entrant 1's Profits in Period 0	$-G$
13	Entrant 1's Profits in Periods 1,...,∞	None

Table 3-3
Fees, Profits and Resource Expenditures for Decision Combination A3 $(\bar{\beta}, \bar{\sigma})$

1	Period 0 Fee	$F^I_{\bar{\sigma}A}$
2	Fee in Periods $1,\ldots,\infty$	$F^I_{\bar{\sigma}A}$
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2(2)]$	$d_1 F^I_{\bar{\sigma}A}$
4	Resources Expended By Incumbent: a. Production Costs in Period 0 b. Production Costs in Each Period $1,\ldots,\infty$ c. Discounted Sum of Production Costs in Periods $0,\ldots,\infty$ $(4a + d_2 4b)$	 C^I C^I $d_1 C^I$
5	Resources Expended By Entrants	None
6	Non-Fee Client Costs	None
7	Discounted Sum of Client Costs in Periods $0,\ldots,\infty$ $(3 + 6)$	$d_1 F^I_{\bar{\sigma}A}$
8	Discounted Sum of Total Resources Expended in Periods $0,\ldots,\infty$ $(4c + 5 + 6)$	$d_1 C^I$
9	Incumbent's Period 0 Profit $(1 - 4a)$	$F^I_{\bar{\sigma}A} - C^I$
10	Discounted Sum of Incumbent's Profits in Periods $1,\ldots,\infty$ $d_2\ (2 - 4b)$	$d_2(F^I_{\bar{\sigma}A} - C^I)$
11	Discounted Sum of Incumbent's Profits in Periods $0,\ldots,\infty$ $(9 + 10)$	$d_1(F^I_{\bar{\sigma}A} - C^I)$
12	Entrant 1's Profits in Periods $0,\ldots,\infty$	None

Table 3-4
Fees, Profits and Resource Expenditures for Decision Combination A4 ($\bar{\beta}, \sigma, \bar{\Delta}$)

1	Period 0 Fee	$F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon$	(3.8)
2	Fee in Periods 1,...,∞	F^I	
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I^*} + d_2F^I$	
4	Resources Expended By Incumbent: a. Production Costs in Period 0 b. Production Costs in Each Period 1,...,∞ c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	 C^I C^I d_1C^I	
5	Resources Expended By Entrants	None	
6	Non-Fee Client Costs	SC	
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + SC + d_2F^I$	
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + SC$	
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I^*} - C^I$	
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F^I - C^I)$	
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I)$	
12	Entrant 1's Profits in Period 0	None	
13	Entrant 1's Profits in Periods 1,...,∞	None	

Table 3-5

Fees, Profits and Resource Expenditures for Decision Combination A5 ($\bar{\beta}$, σ, Δ)

1	Period 0 Fee	$B_1^{E*} = B_2^E + d_2(F_2^E - F_1^E) - \varepsilon$ or (3.5) $B_1^{E*} = B_1^E = B_2^E$ or (3.6) $B_1^{E*} = F_{min}^I - SW + d_2(F^I - F_1^E) - \varepsilon$ (3.7)
2	Fee in Periods 1,...,∞	F_1^E
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E$
4	Resources Expended By Entrants:	
	a. Production Costs in Period 0	$C_1^E + S$
	b. Production Costs in Each Period 1,...,∞	C_1^E
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
	d. Other Period 0 Costs	None
5	Resources Expended By Incumbent	None
6	Non-Fee Client Costs	SW + SC
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + d_2F_1^E$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC$
9	Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S$
10	Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F_1^E - C_1^E)$
11	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E)$
12	Incumbent's Profits in Periods 0,...,∞	None

Table 3-6
Fees, Profits and Resource Expenditures for Decision Combination $\bar{A}1$ (ι, β, Δ)

1	Period 0 Fee	$B_1^{E*} = B_2^E + d_2(F_2^E - F_1^E) - \varepsilon$ or (3.5) $B_1^{E*} = B_1^E = B_2^E$ or (3.6) $B_1^{E*} = F^I_{min} - SW + d_2(F^I - F_1^E) - \varepsilon$ (3.7)
2	Fee in Periods 1,...,∞	F_1^E
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2(2)]$	$B_1^{E*} + d_2F_1^E$
4	Resources Expended By Entrants:	
	a. Production Costs in Period 0	$C_1^E + S$
	b. Production Costs in Each Period 1,...,∞	C_1^E
	c. Discounted Sum of Production Costs in Periods 0,...,∞ $(4a + d_2 4b)$	$d_1C_1^E + S$
	d. Other Period 0 Costs	nG
5	Resources Expended By Incumbent	None
6	Non-Fee Client Costs	$SW + I$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + I + d_2F_1^E$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + I + nG$
9	Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G$
10	Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F_1^E - C_1^E)$
11	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E)$
12	Incumbent's Profits in Periods 0,...,∞	None

Table 3-7
Fees, Profits and Resource Expenditures for Decision Combination $\bar{A}2$ (ι, β, $\bar{\Delta}$)

1	Period 0 Fee	$F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon$ (3.8)
2	Fee in Periods 1,...,∞	F^I
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I^*} + d_2F^I$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5	Resources Expended By Entrants	nG
6	Non-fee Client Costs	I
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + I + d_2F^I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + I + nG$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I^*} - C^I$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F^I - C^I)$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I)$
12	Entrant 1's Profits in Period 0	$-G$
13	Entrant 1's Profits in Periods 1,...,∞	None

Table 3-8
Fees, Profits and Resource Expenditures for Decision Combination $\bar{A}3$ $(\iota, \bar{\beta}, \bar{\sigma})$

1	Period 0 Fee	$F^{I}_{\bar{\sigma}\bar{A}}$
2	Fee in Periods 1,...,∞	$F^{I}_{\bar{\sigma}\bar{A}}$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$d_1 F^{I}_{\bar{\sigma}\bar{A}}$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1 C^I$
5	Resources Expended By Entrants	None
6	Non-Fee Client Costs	I
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 F^{I}_{\bar{\sigma}\bar{A}} + I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1 C^I + I$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I}_{\bar{\sigma}\bar{A}} - C^I$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I}_{\bar{\sigma}\bar{A}} - C^I)$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$d_1(F^{I}_{\bar{\sigma}\bar{A}} - C^I)$
12	Entrant 1's Profits in Periods 0,...,∞	None

Table 3-9
Fees, Profits and Resource Expenditures for Decision Combination $\bar{A}4$ (ι, $\bar{\beta}$, σ, $\bar{\Delta}$)

1	Period 0 Fee	$F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon$ (3.8)
2	Fee in Periods 1,...,∞	F^I
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d2(2)]	$F^{I^*} + d_2F^I$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + d24b)	d_1C^I
5	Resources Expended By Entrants	None
6	Non-Fee Client Costs	$SC + I$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + SC + I + d_2F^I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + SC + I$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I^*} - C^I$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F^I - C^I)$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I)$
12	Entrant 1's Profits in Period 0	None
13	Entrant 1's Profits in Periods 1,...,∞	None

Table 3-10

Fees, Profits and Resource Expenditures for Decision Combination $\overline{A}5$ ($\iota, \overline{\beta}, \sigma, \Delta$)

1	Period 0 Fee	$B_1^{E*} = B_2^E + d_2(F_2^E - F_1^E) - \varepsilon$ or (3.5) $B_1^{E*} = B_1^E = B_2^E$ or (3.6) $B_1^{E*} = F^I_{min} - SW + d_2(F^I - F_1^E) - \varepsilon$ (3.7)
2	Fee in Periods 1, ... ,∞	F_1^E
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E$
4	Resources Expended By Entrants:	
	a. Production Costs in Period 0	$C_1^E + S$
	b. Production Costs in Each Period 1,...,∞	C_1^E
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
	d. Other Period 0 Costs	None
5	Resources Expended By Incumbent	None
6	Non-Fee Client Costs	$SW + SC + I$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + I + d_2F_1^E$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC + I$
9	Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S$
10	Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2 (2 - 4b)	$d_2(F_1^E - C_1^E)$
11	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E)$
12	Incumbent's Profits in Periods 0,...,∞	None

Table 3-11
Fees, Profits and Resource Expenditures for Decision Combination $\bar{A}6$ ($\bar{\iota}$)

1	Period 0 Fee	$F^{I}_{\bar{\iota}}$
2	Fee in Periods 1,...,∞	$F^{I}_{\bar{\iota}}$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$d_1F^{I}_{\bar{\iota}}$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^{I}
	b. Production Costs in Each Period 1,...,∞	C^{I}
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^{I}
5	Resources Expended By Entrants	None
6	Non-Fee Client Costs	I
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1F^{I}_{\bar{\iota}} + I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^{I} + I$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I}_{\bar{\iota}} - C^{I}$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I}_{\bar{\iota}} - C^{I})$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$d_1(F^{I}_{\bar{\iota}} - C^{I})$
12	Entrant 1's Profits in Periods 0,...,∞	None

CHAPTER 4
DERIVATION OF BIDS AND FEES IN THE MARKET FOR AUDITING SERVICES WHEN BIDDING OR SEARCH OCCURS

Chapter 3 describes fee, market participant cost, market participant profit and resource expenditure outcomes for the 5 possible market participant decision combinations in the AAMS and the 6 possible market participant decision combinations in the BAMS. The fee and profit outcomes for decision combinations other than A3, $\bar{A}3$ and $\bar{A}6$ are stated in terms of underived minimum bids (B_1^E, B_2^E, and F_{min}^I) and future fees (F_1^E, F_2^E and F^I) of entrant 1, entrant 2 and the incumbent. This chapter derives these minimum bids and future fees for all possible differences in the production costs of entrant 1, entrant 2 and the incumbent, enabling a restatement of fee and profit outcomes in terms of non-start-up production costs (C_1^E, C_2^E and C^I) or differences in these production costs [(C^I - C_1^E), (C^I - C_2^E) and (C_2^E - C_1^E)], start-up costs (S), client non-fee costs (SW, SC and I) and bidding costs (G). Chapter 4 also defines production cost difference conditions necessary for decision combinations other than A3, $\bar{A}3$ and $\bar{A}6$.

4.1 Method of Derivation of Minimum Bids and Future Fees

An entrant's minimum bid (B_i^E) is derived by setting the sum of current cash flows and the present value of future cash flows equal to zero. The sum of current cash flows, $B_i^E - S - C_i^E$, and the present value of future cash flows, $d_2(F_i^E - C_i^E)$, is

$$B_i^E - S - C_i^E + d_2(F_i^E - C_i^E) \tag{4.1}$$

Setting expression 4.1 to zero, entrant i's minimum bid (B_i^E) is

$B_i^E = d_1 C_i^E + S - d_2 F_i^E$ where

$$d_1 = \frac{1+r}{r} \text{ and } d_2 = \frac{1}{r}.$$

Thus, minimum bids for entrant 1 and entrant 2 are

$$B_1^E = d_1C_1^E + S - d_2F_1^E \text{ and} \tag{4.2}$$

$$B_2^E = d_1C_2^E + S - d_2F_2^E. \tag{4.3}$$

Also,

$$B^I = d_1C^I + S - d_2F^I, \text{ where} \tag{4.4}$$

B^I ≡ the minimum bid of the incumbent in periods 1,...,∞ assuming that the client switches to an entrant in period 0.

The derived value of B^I assumes that the incumbent incurs start-up costs to provide services for the client for any initial period of service following a period in which the client retains another auditing firm. The minimum fee of the incumbent in period 0, F^I_{min}, is also derived by setting the sum of current cash flows and the present value of future cash flows equal to zero. The sum of current cash flows and the present value of future cash flows is

$$F^I_{min} - C^I + d_2 (F^I - C^I). \tag{4.5}$$

Setting expression 4.5 to zero,

$$F^I_{min} = d_1C^I - d_2F^I. \tag{4.6}$$

From equation 4.4, $B^I - S$ equals $d_1C^I - d_2F^I$. Substituting $B^I - S$ for $d_1C^I - d_2F^I$ into equation (4.6) yields

$$F^I_{min} = B^I - S. \tag{4.7}$$

As seen from equations (4.2) - (4.4) and equation (4.6), the higher the future fee charged in periods $1,\ldots,\infty$, the lower the bid. Thus the minimum bid is solved where the future fee is maximum. The maximum future fee for any auditing firm is the maximum of

(i) the fee which prevents entry by the most powerful competitor in periods $1,\ldots,\infty$, the entry limiting fee, and

(ii) the auditing firm's production cost in periods $1,\ldots,\infty$.

The entry limiting fee is set at a level slightly below the client's cost of hiring the most powerful competitor in periods $1,\ldots,\infty$. For example, assume $B_2^E + d_2F_2^E + SW < B^I + d_2F^I + SW$ holds. Entrant 1's most powerful competitor is entrant 2. Entrant 1's entry limiting fee is set such that the client's discounted cost of retaining entrant 1 in periods $1,\ldots,\infty$ is less than the client's minimum cost of hiring entrant 2, i.e.

$$F_1^E + d_2 F_1^E < B_2^E + SW + d_2F_2^E. \tag{4.8}$$

From equation (4.3),

$$B_2^E + d_2 F_2^E = d_1C_2^E + S. \tag{4.9}$$

Substituting $d_1C_2^E + S$ for $B_2^E + d_2F_2^E$ and combining terms on the left-hand side, equation (4.8) is rewritten as

$$d_1F_1^E < d_1C_2^E + S + SW.$$

This relationship holds when

$$d_1F_1^E = d_1C_2^E + S + SW - \varepsilon \tag{4.10}$$

where ε is a small amount. Let $S + SW - \varepsilon$ be defined as S^*. Dividing through by d_1 and substituting S^* for $S + SW - \varepsilon$, equation (4.10) is rewritten as

---

$$F_1^E = C_2^E + d_{10}S^* \text{ where} \tag{4.11}$$

$$d_{10} = \frac{r}{1+r}.$$

If $B^I + d_2F^I + SW < B_2^E + d_2F_2^E + SW$, entrant 1's most powerful competitor is the incumbent. In this case, entrant 1 sets it's entry limiting fee such that the client's discounted cost of retaining entrant 1 in periods 1,...,∞ is less than the client's minimum cost of rehiring the incumbent, i.e.,

$$F_1^E + d_2F_1^E < B^I + SW + d_2F^I. \tag{4.12}$$

Substituting $d_1C^I + S$ for $B^I + d_2F^I$ from equation 4.4, equation 4.12 is rewritten as

$$d_1F_1^E < d_1C^I + S + SW.$$

This relationship holds when

$$d_1F_1^E = d_1C^I + S + SW - \varepsilon. \tag{4.13}$$

Dividing through by d_1 and substituting S^* for $S + SW - \varepsilon$, the entry limiting fee in equation 4.13 is rewritten as

$$F_1^E = C^I + d_{10}S^*. \tag{4.14}$$

Entrant 2's entry limiting fees are similarly derived. Where $B_1^E + d_2F_1^E + SW < B^I + d_2F^I + SW$, entrant 1 is entrant 2's most powerful competitor and entrant 2's entry limiting fee is, by symmetry,

$$F_2^E = C_1^E + d_{10}S^*. \tag{4.15}$$

Where $B^I + d_2F^I + SW < B_1^E + d_2F_1^E + SW$, the incumbent is entrant 2's most powerful competitor in periods 1,...,∞. Again, by symmetry,

$$F_2^E = C^I + d_{10}S^*. \tag{4.16}$$

As $B_1^E + d_2F_1^E + SW$ is always less than $B_2^E + d_2F_2^E + SW$, entrant 1 is always the incumbent's most powerful competitor of the incumbent. Thus, the incumbent's entry limiting fee is always

$$F^I = C_1^E + d_{10}S^*. \tag{4.17}$$

As previously discussed, the maximum future fee for any auditing firm is the maximum of

(i) the fee which prevents entry by the most powerful competitor in periods 1,..., ∞ (the entry limiting fee) and

(ii) the auditing firm's production cost in periods 1,...,∞.

Therefore, in the case of entrant 1, where the entry limiting fee is the minimum of $C_2^E + d_{10}S^*$ [equation (4.11)] and $C^I + d_{10}S^*$ [equation (4.14)],

$$F_1^E = \max\,[\min\,(C_2^E + d_{10}S^*,\ C^I + d_{10}S^*),\ C_1^E\,]. \tag{4.18}$$

Similarly,

$$F_2^E = \max\,[\min\,(C_1^E + d_{10}S^*,\ C^I + d_{10}S^*),\ C_2^E\,],\ \text{and} \tag{4.19}$$

$$F^I = \max\,[C_1^E + d_{10}S^*,\ C^I]. \tag{4.20}$$

Derivation of F_1^E thus requires knowledge of the relationships between C_1^E, $C_2^E + d_{10}S^*$ and $C^I + d_{10}S^*$, as described in equation 4.18. Similarly, derivation of F_2^E requires knowledge of the relationships between $C_1^E + d_{10}S^*$, $C^I + d_{10}S^*$ and C_2^E and derivation of F^I requires an assumption regarding the relationship between $C_1^E + d_{10}S^*$ and C^I. Four sets of assumptions are made to derive F_1^E, F_2^E and F^I for all consistent orderings of C_1^E, $C_1^E + d_{10}S^*$, C_2^E, $C_2^E + d_{10}S^*$, C^I and $C^I + d_{10}S^*$. First, let **R** be defined as the set of all possible assumptions regarding the order of costs and define R_i as a subset of **R** where i = 1,...,8, and

$R_1 = [C_1^E = C_2^E = C^I]$,

$R_2 = [C_1^E < C_2^E < C^I]$,

$R_3 = [C_1^E = C_2^E < C^I]$,

$R_4 = [C_1^E < C_2^E = C^I]$,

$R_5 = [C_1^E < C^I < C_2^E]$,

$R_6 = [C_1^E = C^I < C_2^E]$,

$R_7 = [C^I < C_1^E < C_2^E]$ and

$R_8 = [C^I < C_1^E = C_2^E]$.

Second, let $\mathbf{E^1}$ be defined as a set of assumptions regarding the relationship between $\min(C_2^E + d_{10}S^*, C^I + d_{10}S^*)$ and C_1^E in equation (4.18), and define E_j^1 as a subset of $\mathbf{E^1}$ where j = 1, 2 and

$E_1^1 = [\min(C_2^E + d_{10}S^*, C^I + d_{10}S^*) > C_1^E]$ and

$E_2^1 = [\min(C_2^E + d_{10}S^*, C^I + d_{10}S^*) < C_1^E]$.

For simplicity, strict inequalities are assumed for the relationship between $\min(C_2^E + d_{10}S^*, C^I + d_{10}S^*)$ and C_1^E.

Third, let $\mathbf{E^2}$ be defined as the set of assumptions regarding the relationship between $\min(C_1^E + d_{10}S^*, C^I + d_{10}S^*)$ and C_2^E in equation (4.19), and define E_k^2 as a subset of $\mathbf{E^2}$, where k = 1 , 2, and where

$E_1^2 = [\min(C_1^E + d_{10}S^*, C^I + d_{10}S^*) > C_2^E]$ and

$E_2^2 = [\min(C_1^E + d_{10}S^*, C^I + d_{10}S^*) < C_2^E]$.

For simplicity, strict inequalities are assumed for the relationship between $\min(C_1^E + d_{10}S^*, C^I + d_{10}S^*)$ and C_2^E.

Fourth, define **I** as the set of assumptions regarding the relationship between $C_1^E + d_{10}S^*$ and C^I in equation (4.20), and define I_p as a subset of **I** where p = 1, 2 and

$I_1 = [C_1^E + d_{10}S^* > C^I]$ and

$I_2 = [C_1^E + d_{10}S^* < C^I]$.

Again, strict inequalities are assumed. The cartesian product of **R**, $\mathbf{E^1}$, $\mathbf{E^2}$, and **I** is

$$\mathbf{R} \otimes \mathbf{E^1} \otimes \mathbf{E^2} \otimes \mathbf{I} = \{(R_i, E_j^1, E_k^2, I_p) | \; R_i \in \mathbf{R},\; E_j^1 \in \mathbf{E^1},\; E_k^2 \in \mathbf{E^2},\; I_p \in \mathbf{I}\}$$

and includes 64 members. Let **S** be defined as the set of consistent subsets of $\mathbf{R} \otimes \mathbf{E^1} \otimes \mathbf{E^2} \otimes \mathbf{I}$. A consistent subset is defined as one in which the ordering of costs is consistent across all assumptions included in the subset, i.e., R_i, E_j^1, E_k^2 and I_p. For example, the assumed cost orders for subset (R_5, E_1^1, E_1^2, I_2) are as follows:

$R_5 = [C_1^E < C^I < C_2^E]$,

$E_1^1 = [\min(C_2^E + d_{10}S^*, C^I + d_{10}S^*) > C_1^E]$,

$E_1^2 = [\min(C_1^E + d_{10}S^*, C^I + d_{10}S^*) > C_2^E]$ and

$I_2 = [C_1^E + d_{10}S^* < C^I]$.

Note that the cost ordering for R_5 determines the minimum for E_1^1 and E_1^2. E_1^1 and E_1^2 are rewritten as

E_1^1: $C^I + d_{10}S^* > C_1^E$ and

E_1^2: $C_1^E + d_{10}S^* > C_2^E$.

By inspection, E_1^2 and I_2 are seen to be inconsistent with R_5, as E_1^2 and I_2 assume

$C_2^E < C_1^E + d_{10}S^* < C^I$ and

R_5 assumes

$C^I < C_2^E$.

The process of identifying inconsistent assumptions within subsets is repetitive, and description of inconsistent assumptions of the remaining inconsistent subsets is omitted. Eighteen of the sixty-four subsets are identified as consistent. The set **S** is sufficient to derive fees (F_1^E, F_2^E and F^I) in equations (4.18) - (4.20) for all cost relationships. An assumption regarding the cost relationship (R_i) determines the minimum of $C_2^E + d_{10}S^*$ and $C^I + d_{10}S^*$ in E_j^1 and the minimum of $C_1^E + d_{10}S^*$ and $C^I + d_{10}S^*$ in E_k^2. Then, E_j^1, E_k^2 and I_p determine the fees F_1^E, F_2^E, and F^I, respectively.

4.2 Description of Cost Relationships, Future Fees and Minimum Bids for Subsets of S

Tables 4-1 and 4-2 describe the eighteen consistent subsets. Table 4-1 describes the assumed relationships between costs (column 2), fees which entrant 1, entrant 2 and the incumbent will charge in periods subsequent to the first period of service (column 3), and minimum bids (column 4).

4.2.1 Assumed Cost Relationships for Subsets of S

Assumed cost relationships (column 2 of Table 4-1) are determined by ordering costs in accordance with assumptions R_i, E^1_j, E^2_k and I_p. For example, on Table 4-1, assumptions for subset (R_5, E^1_1, E^2_1, I_1) are as follows:

$R_5 = [C^E_1 < C^I < C^E_2]$,

$E^1_1 = [\min(C^E_2 + d_{10}S^*, C^I + d_{10}S^*) > C^E_1]$,

$E^2_1 = [\min(C^E_1 + d_{10}S^*, C^I + d_{10}S^*) > C^E_2]$ and

$I_1 = [C^E_1 + d_{10}S^* > C^I]$.

The cost ordering in assumption R_5 determines the minimum for E^1_1 and E^2_1. E^1_1 and E^2_1 are rewritten as

E^1_1: $C^I + d_{10}S^* > C^E_1$ and

E^2_1: $C^E_1 + d_{10}S^* > C^E_2$.

Given assumptions R_5,E^1_1, E^2_1 and I_1, the order of C^E_1, C^E_2, C^I, $C^E_1 + d_{10}S^*$, $C^E_2 + d_{10}S^*$, and $C^I + d_{10}S^*$ is

$$C^E_1 < C^I < C^E_2 < C^E_1 + d_{10}S^* < C^I + d_{10}S^* < C^E_2 + d_{10}S^*.$$

This cost relationship is described in column 2 of Table 4-1. The cost relationships of each subset (R_i, E^1_j, E^2_k, I_p) are similarly determined.

4.2.2 Fees in Periods 1,...,∞ for Subsets of S

Fees in future periods are also determined from the assumptions. For example, given assumption R_5 where $C^I < C^E_2$ and assumption E^1_1 from subset (R_5,E^1_1, E^2_1, I_1), entrant 1 charges $C^I + d_{10}S^*$. This fee limits entry in each period 1,...,∞. Given assumptions R_5 and E_1^2 from subset (R_5, E_1^1, E_1^2, I_1), entrant 2 charges $C_1^E + d_{10}S^*$. Similarly, F^I is determined to be $C_1^E + d_{10}S^*$ from assumption I_1 of subset (R_5, E_1^1, E_1^2, I_1).

4.2.3 Minimum Bids for Subsets of S

Given fees in future periods as described in column 3 of Table 4-1, minimum bids are easily derived and are described in column 4 of Table 4-1. Again, using subset (R_5, E_1^1, E_1^2, I_1) as an example, B_1^E and B_2^E are determined by substituting F_1^E and F_2^E into equations 4.2 and 4.3, respectively. B^I and F_{min}^I are determined by substituting F^I into equations 4.4 and 4.6, respectively.

4.3 Switching Decisions for Subsets of S

Given the minimum bids (column 4) and the fees that the client will pay to each audit firm in periods 1,...,∞ (column 3), the bidding relationships of entrant 1, entrant 2 and the incumbent correspond to the bidding model described in (3.1) - (3.4), i.e.,

$$B_1^E + d_2 F_1^E + SW < B_2^E + d_2 F_2^E + SW \le F_{min}^I + d_2 F^I \qquad (3.1)$$

$$B_1^E + d_2 F_1^E + SW = B_2^E + d_2 F_2^E + SW < F_{min}^I + d_2 F^I \qquad (3.2)$$

$$B_1^E + d_2 F_1^E + SW < F_{min}^I + d_2 F^I \le B_2^E + d_2 F_2^E + SW \qquad (3.3)$$

$$F_{min}^I + d_2 F^I < B_1^E + d_2 F_1^E + SW \le B_2^E + d_2 F_2^E + SW \qquad (3.4)$$

Switching occurs (does not occur) if

$$B_1^E + d_2F_1^E + SW < F_{min}^I + d_2F^I$$

$$(F_{min}^I + d_2F^I < B_1^E + d_2F_1^E + SW).$$

For example, switching occurs for subset (R_2, E_1^1, E_1^2, I_2) (Table 4-1) if

$$B_1^E + d_2F_1^E + SW < F_{min}^I + d_2F^I.$$

Restating $B_1^E + d_2F_1^E + SW$ and $F_{min}^I + d_2F^I$ in terms of the solutions in columns (3) and (4) of Table 4-1 for subset (R_2, E_1^1, E_1^2, I_2) yields

$$d_1C_1^E - d_2C_2^E + S - d_7S^* + d_2(C_2^E + d_{10}S^*) + SW < C^I + d_2C^I.$$

Algebraic rearrangement of terms yields

$$C_1^E + d_{10}(S^* + \varepsilon) < C^I.$$

The cost relationships described in column 2 show that, ignoring $d_{10}\varepsilon$ where ε is a very small amount, this relationship always holds for subset (R_2, E_1^1, E_1^2, I_2). Thus, the client switches from the incumbent to entrant 1 in period 0. "Δ" or "$\overline{\Delta}$" in column 1 of Table 4-2 indicates that the client switches in period 0 or does not switch, respectively. Determination of the switching decision for each subset assuming bidding or client search is similarly derived.

4.4 Period 0,...,∞ Fee Solutions for Subsets of **S**

Table 4-2 describes the fee solutions (column 2) for each of the subsets which occur when bidding occurs in period 0 or when bidding does not occur and the client searches for fee information. When switching occurs, entrant 1 sets its fee at an amount such that the client's cost of hiring entrant 1 is slightly less than the client's cost of hiring entrant 1's most powerful competitor. As discussed in Chapter 3, where minimum bids and future fees are ordered as in (3.1),

$$B_1^{E*} = B_2^E + d_2(F_2^E - F_1^E) - \varepsilon. \tag{4.21}$$

See equation (3.5). From equation (3.6) where minimum bids and future fees are ordered as in (3.2),

$$B_1^{E*} = B_2^{E*} = B_1^E = B_2^E \tag{4.22}$$

From equation (3.7) where minimum bids and future fees are ordered as in (3.3),

$$B_1^{E^*} = F_{min}^I - SW + d_2(F^I - F_1^E) - \varepsilon. \tag{4.23}$$

Substituting $B_1^E + d_2F_1^E = d_1C_1^E + S$ from equation (4.2), $B_2^E + d_2F_2^E = d_1C_2^E + S$ from equation (4.3) and $F_{min}^I + d_2F^I = d_1C^I$ from equation (4.6), bid relationships (3.1), (3.2) and (3.3) are rewritten, respectively, as

$$d_1C_1^E + S^* + \varepsilon < d_1C_2^E + S^* + \varepsilon \leq d_1C^I, \tag{4.24}$$

$$d_1C_1^E + S^* + \varepsilon = d_1C_2^E + S^* + \varepsilon < d_1C^I \text{ and} \tag{4.25}$$

$$d_1C_1^E + S^* + \varepsilon < d_1C^I \leq d_1C_2^E + S^* + \varepsilon. \tag{4.26}$$

Dividing through by d_1, (4.24), (4.25) and (4.26) are rewritten as

$$C_1^E + d_{10}(S^* + \varepsilon) < C_2^E + d_{10}(S^* + \varepsilon) < C^I, \tag{4.27}$$

$$C_1^E + d_{10}(S^* + \varepsilon) = C_2^E + d_{10}(S^* + \varepsilon) \leq C^I \text{ and} \tag{4.28}$$

$$C_1^E + d_{10}(S^* + \varepsilon) < C^I \leq C_2^E + d_{10}(S^* + \varepsilon). \tag{4.29}$$

From inspection of cost relationships in column 2 of Table 4-1 and ignoring $d_{10}\varepsilon$, (4.27) is consistent with cost relationships for subsets (R_2, E_1^1, E_1^2,I_2) and (R_2, E_1^1,E_2^2,I_2). Substituting values of B_2^E, F_2^E and F_1^E from Table 4-1 into (4.21) yields

$$B_1^{E^*} = C_2^E + d_{10}S^* - SW + \varepsilon. \tag{4.30}$$

for both subsets (R_2, E_1^1, E_1^2, I_2) and (R_2, E_1^1, E_2^2, I_2). Cost relationship (4.28) is consistent with cost relationships shown in column 2 of Table 4-1 for subset (R_3, E_1^1, E_1^2, I_2). Substituting $B_1^E = B_2^E$ from Table 4-1 into (4.22),

$$B_1^{E^*} = d_1C_1^E - d_2C_2^E + S - d_7S^*.$$

As $C_1^E = C_2^E$,

$$B_1^{E^*} = C_2^E + S - d_7S^*. \tag{4.31}$$

Cost relationship (4.29) is consistent with cost relationships described in column 2 of Table 4-1 for subsets (R_2, E_1^1, E_1^2, I_2), (R_2, E_1^1, E_2^2, I_2), (R_4, E_1^1, E_2^2, I_2), and (R_5, E_1^1, E_2^2, I_2). Substitution of F_{min}^I, F^I and F_1^E for each subset (R_2, E_1^1, E_1^2, I_2), (R_2, E_1^1, E_2^2, I_2) and (R_4, E_1^1, E_2^2, I_2) into equation (4.23) yields

$$B_1^{E^*} = d_1C^I - d_2C_2^E - d_7S^* - SW - \varepsilon. \tag{4.32}$$

Substituting F_{min}^I, F^I and F_1^E from Table 4-1 for subset (R_5, E_1^1, E_2^2, I_2) into equation (4.23) yields

$$B_1^{E^*} = C^I - SW - d_7S^* - \varepsilon. \tag{4.33}$$

When bidding occurs in period 0 and the client does not switch, the incumbent sets its fee at an amount such that the client's cost of retaining the incumbent is slightly less than the client's cost of hiring the incumbent's most powerful competitor. As discussed in Chapter 3, where minimum bids and future fees are ordered as in (3.2), the client retains the incumbent, and from equation (3.8), the incumbent charges

$$F^{I^*} = B_1^E + SW + d_2(F_1^E - F^I) - \varepsilon. \tag{4.34}$$

Ignoring entrants other than entrant 1 and entrant 2 and substituting $B_1^E + d_2F_1^E = d_1C_1^E + S$ from equation (4.2), $B_2^E + d_2F_2^E = d_1C_2^E + S$ from equation (4.3) and $F_{min}^I + d_2F^I = d_1C^I$ from equation (4.6), (3.4) is rewritten as

$$d_1C^I < d_1C_1^E + S^* + \varepsilon \leq d_1C_2^E + S^* + \varepsilon. \tag{4.35}$$

Dividing terms in (4.34) by d_1, (4.34) is rewritten as

$$C^I < C_1^E + d_{10}(S^* + \varepsilon) \leq C_2^E + d_{10}(S^* + \varepsilon). \tag{4.36}$$

From inspection of cost relationships in column 2 of Table 4-1, (4.36) is consistent with cost relationships for subsets (R_1, E_1^1, E_1^2, I_1), (R_2, E_1^1, E_1^2, I_1), (R_3, E_1^1, E_1^2, I_1), (R_4, E_1^1, E_1^2, I_1), (R_5, E_1^1, E_1^2, I_1), (R_5, E_1^1, E_2^2, I_1), (R_6, E_1^1, E_1^2, I_1), (R_6, E_1^1, E_2^2, I_1), (R_7, E_1^1, E_1^2, I_1), $(R_7, E_1^1, E_2^2, I_1)(R_7, E_2^1, E_2^2, I_1)$, (R_8, E_1^1, E_1^2, I_1) and (R_8, E_2^1, E_2^2, I_1). Substituting values of B_1^E, F_1^E and F^I from each of these subsets into (4.34) yields

$$F^{I^*} = C_1^E + d_{10}S^*. \tag{4.37}$$

In summary, period 0 fees as derived in equations (4.30), (4.31), (4.32), (4.33) and (4.37) are shown in column 2 of Table 4-2 for each subset of **S**. The fees charged in periods 1,...∞ for each subset of **S** are also described in column 2 of Table 4-2.

4.5 Cost Difference Conditions Necessary for Subsets of S

Column 3 of Table 4-2 describes the cost difference conditions necessary for each subset of **S**.

Terms used in these tables and in subsequent analyses related to cost differences are defined as follows:

$\mathbf{C_1^E}$ ≡ the set of possible production costs for entrant 1 where C_1^E represents a specific value of the set $\mathbf{C_1^E}$.

$\mathbf{C_2^E}$ ≡ the set of possible production costs for entrant 2 where C_2^E represents a specific value of the set $\mathbf{C_2^E}$.

ρ ≡ the set of possible differences between a fixed production cost for the incumbent and the production cost for entrant 1 where ρ represents a specific member of the set ρ. $\rho = C^I - \mathbf{C_1^E}$ and $\rho = C^I - C_1^E$.[1]

C_{1k}^E ≡ a member of $\mathbf{C_1^E}$ where $k = (1,\ldots, q + m + 1)$.

ρi ≡ a member of ρ where $\rho i = (-q,\ldots,m)$ and $\rho i = C^I - C_{1k}^E$.

---

[1] The definition of C_1^E, C_2^E and C^I is consistent with previous usage of these terms in this paper.

$\alpha \equiv$ the set of all possible differences between the production costs of entrant 2 and entrant 1 where α represents a specific member of the set α .

$\alpha_j \equiv$ a member of α where $\alpha_j = (0,\ldots,m)$ and

$\alpha_j = C^E_{2s} - C^E_{1k}$.

$C^E_{2s} \equiv$ a member of $\mathbf{C^E_2}$ where $s = (1,\ldots,q + 2m + 1)$.

$\gamma \equiv$ the set of possible differences between a fixed production cost for the incumbent and entrant 2's production cost where γ represents a specific member of the set γ. $\gamma = C^I - \mathbf{C^E_2}$ and $\gamma = C^I - C^E_2$.

$\gamma_{i-j} \equiv$ a subset of γ where $\gamma_{i-j} = (-q-m,\ldots,m)$ and $\gamma_{i-j} = C^I - C^E_{2s}$.

Given the above definitions,

$$C^E_1 = C^I - \rho = C^E_2 - \alpha \text{ and} \tag{4.38}$$

$$C^E_2 = \alpha + C^E_1 = C^I - \gamma. \tag{4.39}$$

Substituting values of C^E_1 and C^E_2 from equations (4.38) and (4.39) into cost relationships described in column 2 of Table 4-1 yields the cost difference regions for each subset of **S** as described in column 3 of Table 4-2. These cost difference regions as defined in the tables are graphed on Figure 4-1 for the eighteen subsets of **S**.

4.6 Regrouping of Subsets of **S** Into Subsets With Identical Fee Outcomes

In summary, assumptions R_i ,E^1_j, E^2_k and I_p are used to derive fees in periods $0,\ldots,\infty$ as described in column 2 of Table 4-2 and to define regions in terms of cost differences in which the assumptions for each subset of **S** are consistent. The number of fee outcome sets can be reduced from the eighteen described subsets of **S** by combining all subsets having identical fee outcomes for each period $0,\ldots,\infty$. Let θ be defined as the set of possible fee solutions given bidding or search and define θ_i as a member of θ where $i = (1,\ldots,5)$. Table 4-3 describes the subsets of θ in terms of the period 0 fee, fee in periods $1,\ldots,\infty$ (column 2) and cost difference regions (column 3). Column 1 of Table

4-2 identifies each subset of **S** with the subset of θ having the same fee solution. Figure 4-2 depicts the cost difference regions for all subsets of θ.

4.7 Restatement of Fee, Cost, Profit and Resource Expenditure Outcomes for Decision Combinations in Terms of Differences in Production Costs (ρ, α) and Other Costs

The diagram of possible decision combinations described in Figure 3-1 is expanded in Figure 4-3 by subdividing decision combinations occurring subsequent to bidding or search (A1, A2, A4, A5, $\bar{A}1$, $\bar{A}2$, $\bar{A}4$ and $\bar{A}5$) in terms of cost difference regions θ_1 - θ_5. This results in 23 decision-cost combinations. Fee, market participant cost, market participant profit and resource expenditure outcomes for each of these decision-cost combinations are described in Appendix A on the following tables:

OUTCOME	TABLE	OUTCOME	TABLE
A1(θ_2)	A-1	$\bar{A}1(\theta_2)$	A-12
A1(θ_3)	A-2	$\bar{A}1(\theta_3)$	A-13
A1(θ_4)	A-3	$\bar{A}1(\theta_4)$	A-14
A1(θ_5)	A-4	$\bar{A}1(\theta_5)$	A-15
A2(θ_1)	A-5	$\bar{A}2(\theta_1)$	A-16
A4(θ_1)	A-7	$\bar{A}4(\theta_1)$	A-18
A5(θ_2)	A-8	$\bar{A}5(\theta_2)$	A-19
A5(θ_3)	A-9	$\bar{A}5(\theta_3)$	A-20
A5(θ_4)	A-10	$\bar{A}5(\theta_4)$	A-21
A5(θ_5)	A-11	$\bar{A}5(\theta_5)$	A-22

Fee, market participant cost, market participant profit and resources expenditure outcomes as described in tables (A-1) through (A-22) are derived by substituting solutions for B_1^{E*} and F_1^{E} or F^{I*} and F^{I} as described for each θ_i in Table 4-3 into the fee, market participant cost, market participant profit and resource expenditure outcome solutions described on Tables 3-1 through 3-11.

4.8 Summary Comments and Additional Work Required for Policy Comparisons

Chapter 4 describes derivations of bids and fees, when bidding or search occurs in the BAM or AAM, i.e., for decision combinations other than A3, $\bar{A}3$ and $\bar{A}6$. Five outcome solutions corresponding to five cost difference regions are derived. When bidding or search occurs and cost differences lie in θ_1, the client minimizes costs by retaining the incumbent. Fee and bid solutions along with a description of cost difference region θ_1 are described on Table 4-3. When bidding or search occurs and cost differences lie in $\theta_2 - \theta_5$, the client's cost-minimizing decision is to switch audit firms. Table 4-3 describes the period 0 fee and fee in periods $1,...,\infty$ for $\theta_2 - \theta_5$ and describes the boundaries of the cost difference regions. Figure 4-2 depicts cost difference regions $\theta_1 - \theta_5$.

The primary purpose of Chapter 4 is to derive fees and bids when bidding or search occurs in the BAM or the AAM. These fees and bids are substituted into decision combination outcomes described in Tables 3-1 through 3-11 and yield fee, profit and resource expenditure outcomes for all possible ρ, α, and γ for the BAM and the AAM, as described in Appendix A. Chapter 5 derives outcomes when bidding and search do not occur. Given these derivations, the results of comparisons of fee, cost, profit and resource expenditure outcomes for the BAM and the AAM are described in Chapter 6.

Apart from the usefulness of Chapter 4 derivations for solicitation policy comparisons, several observations, independent from the solicitation policy issue, can be made regarding the market for audit services. These observations hold for both the BAM and the AAM.

First, the client's decision to switch audit firms depends only on the difference in the efficiency of the incumbent and entrant 1. Switching occurs only when entrant 1 is more efficient than the incumbent by a margin of at least $d_{10}(S^* + \varepsilon)$. Thus, given start-up costs (S) and switching costs (SW), an entrant capable of providing the audit service at a lower cost is prevented from entry unless the difference in costs (ρ) exceeds $d_{10}(S^* + \varepsilon)$.

Second, fee solutions for cost difference regions depend upon the production costs of the most powerful competitor. For example, fee solutions for cost difference region θ_1, where the client retains the incumbent, depend upon the production costs of entrant 1, the incumbent's most powerful competitor. These fee solutions are described on Table 4-3. Fee solutions for θ_2, where the client switches to either entrant 1 or entrant 2 and entrant 1 and entrant 2 are equally efficient, depend upon the production costs of the equally efficient audit firms, i.e. C_2^E or C_1^E, where $C_2^E = C_1^E$. Fee solutions for θ_3, where the client switches to entrant 1 in period 0, depend upon the production costs of entrant 2, as entrant 2 is entrant 1's most powerful competitor in periods $0,\ldots,\infty$. Similarly, fee solutions for θ_5, where the client switches to entrant 1 in period 0, depend upon the production costs of the incumbent as the incumbent is entrant 1's most powerful competitor in periods $0,\ldots,\infty$. The fee solutions for θ_4, where the client switches to entrant 1 in period 0, depend upon the production costs of both the incumbent and entrant 2 in period 0 and only upon entrant 2 in periods subsequent to period 0. For θ_4, the incumbent is entrant 1's most powerful competitor in period 0, even though $C_2^E < C^I$ or $\gamma > 0$, and entrant 2 is entrant 1's most powerful competitor in periods subsequent to period 0. This shift occurs as the incumbent loses it's advantage in the market once the client switches.

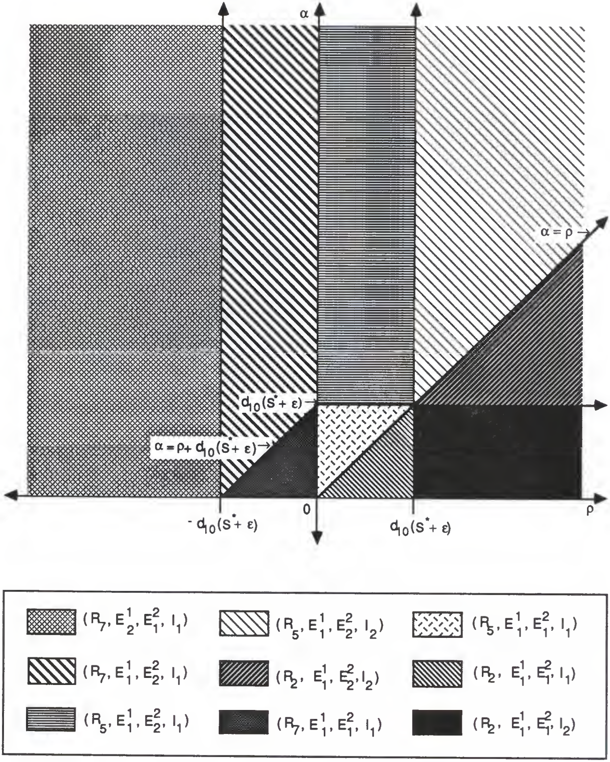
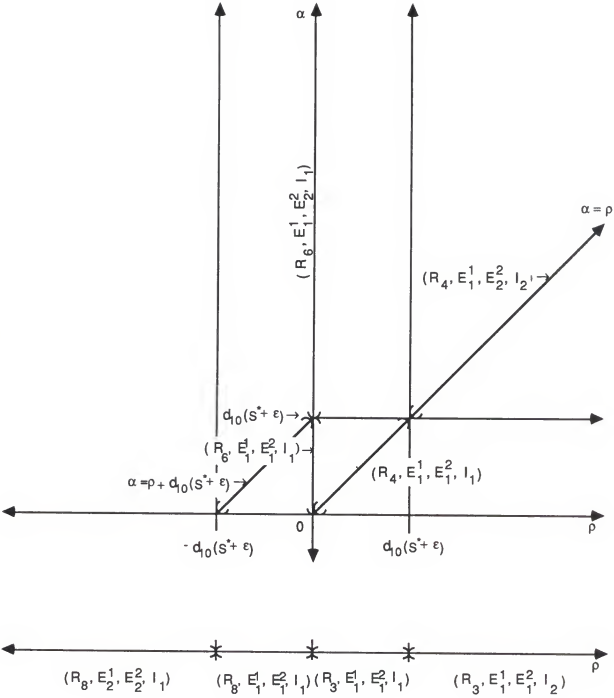

α
$\alpha = \rho \rightarrow$
$d_{10}(S^* + \varepsilon) \rightarrow$
$\alpha = \rho + d_{10}(S^* + \varepsilon) \rightarrow$
0
ρ
$-d_{10}(S^* + \varepsilon)$
$d_{10}(S^* + \varepsilon)$
(R_7, E_2^1, E_1^2, I_1)
(R_5, E_1^1, E_2^2, I_2)
(R_5, E_1^1, E_1^2, I_1)
(R_7, E_1^1, E_2^2, I_1)
(R_2, E_1^1, E_2^2, I_2)
(R_2, E_1^1, E_1^2, I_1)
(R_5, E_1^1, E_2^2, I_1)
(R_7, E_1^1, E_1^2, I_1)
(R_2, E_1^1, E_1^2, I_2)

Figure 4-1A
Cost Difference Regions for All Subsets of **S**



α
(R_6, E_1^1, E_2^2, I_1)
$\alpha = \rho$
$(R_4, E_1^1, E_2^2, I_2) \rightarrow$
$d_{10}(s^* + \varepsilon) \rightarrow$
$(R_6, E_1^1, E_1^2, I_1) \rightarrow$
$\alpha = \rho + d_{10}(s^* + \varepsilon) \rightarrow$
(R_4, E_1^1, E_1^2, I_1)
0
ρ
$-d_{10}(s^* + \varepsilon)$
$d_{10}(s^* + \varepsilon)$
ρ
(R_8, E_2^1, E_2^2, I_1)
(R_8, E_1^1, E_1^2, I_1)
(R_3, E_1^1, E_1^2, I_1)
(R_3, E_1^1, E_1^2, I_2)

Figure 4-1B
Cost Difference Regions for All Subsets of **S**

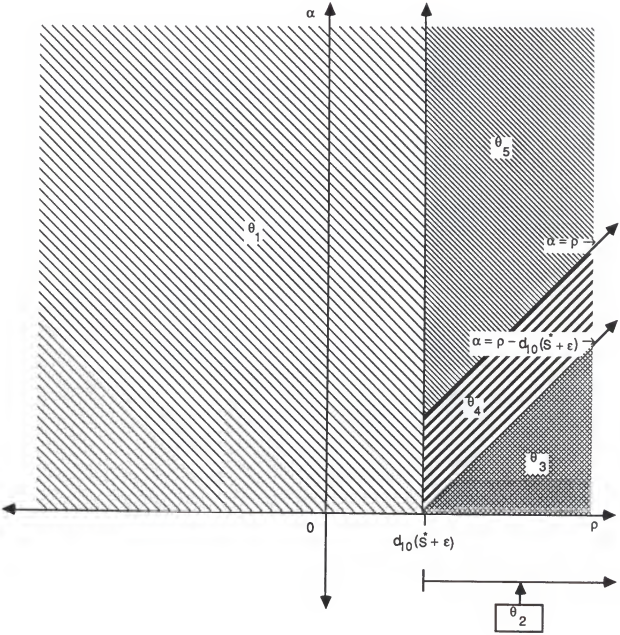


Figure 4-2
Cost Difference Regions for All Subsets of θ

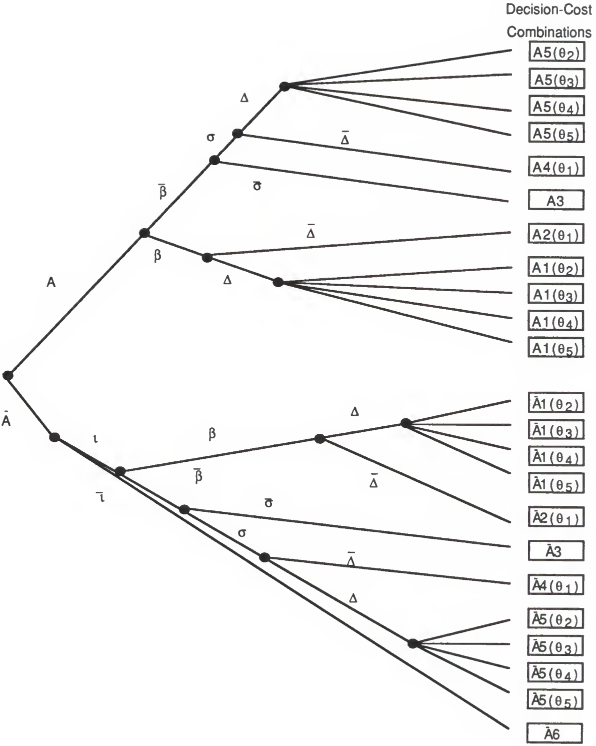


Figure 4-3
Flow of Decisions in the AAM and the BAM

Table 4-1
Assumed Cost Relationships, Fees in Periods 1,...,∞ and Minimum Bids for Subsets of **S**

(1) (Subset of **S**)	(2) Assumed Cost Relationships	(3) Fees in Periods 1,...,∞	(4) Minimum Bids
(R_1, E_1^1, E_1^2, I_1)	$C_1^E = C_2^E = C^I < C_1^E + d_{10}S^* = C_2^E + d_{10}S^* = C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$
(R_2, E_1^1, E_1^2, I_1)	$C_1^E < C^I < C_1^E + d_{10}S^* < C_2^E + d_{10}S^* < C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$
(R_2, E_1^1, E_1^2, I_2)	$C_1^E < C_2^E < C_1^E + d_{10}S^* < C_2^E + d_{10}S^* < C^I + d_{10}S^*;$ $C_1^E + d_{10}S^* < C^I$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C^I$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = C^I + S$ $F_{min}^I = C^I$
(R_2, E_1^1, E_2^2, I_2)	$C_1^E < C_1^E + d_{10}S^* < C_2^E < C_2^E + d_{10}S^* < C^I + d_{10}S^*;$ $C_1^E + d_{10}S^* < C^I$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_2^E$ $F^I = C^I$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = C_2^E + S$ $B^I = C^I + S$ $F_{min}^I = C^I$
(R_3, E_1^1, E_1^2, I_1)	$C_1^E = C_2^E < C^I < C_1^E + d_{10}S^* < C_2^E + d_{10}S^* < C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$

Table 4-1--continued
Assumed Cost Relationships, Fees in Periods 1,...,∞ and Minimum Bids for Subsets of **S**

(1) (Subset of **S**)	(2) Assumed Cost Relationships	(3) Fees in Periods 1,...,∞	(4) Minimum Bids
(R_3, E_1^1, E_1^2, I_2)	$C_1^E = C_2^E < C_1^E$ $+ d_{10} S^*$ $= C_2^E + d_{10}S^*$ $< C^I < C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C^I$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = C^I + S$ $F_{min}^I = C^I$
(R_4, E_1^1, E_1^2, I_1)	$C_1^E < C_2^E = C^I$ $< C_1^E + d_{10}S^*$ $< C_2^E + d_{10}S^*$ $= C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$
(R_4, E_1^1, E_2^2, I_2)	$C_1^E < C_1^E + d_{10}S^*$ $< C^I = C_2^E < C_2^E$ $+ d_{10}S^*$ $= C^I + d_{10}S^*$	$F_1^E = C_2^E + d_{10}S^*$ $F_2^E = C_2^E$ $F^I = C^I$	$B_1^E = d_1C_1^E - d_2C_2^E + S - d_7S^*$ $B_2^E = C_2^E + S$ $B^I = C^I + S$ $F_{min}^I = C^I$
(R_5, E_1^1, E_1^2, I_1)	$C_1^E < C^I < C_2^E$ $< C_1^E + d_{10}S^*$ $< C^I + d_{10}S^*$ $< C_2^E + d_{10}S^*$	$F_1^E = C^I + d_{10}S^*$ $F_2^E = C_1^E + d_{10}S^*$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C^I + S - d_7S^*$ $B_2^E = d_1C_2^E - d_2C_1^E + S - d_7S^*$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$
(R_5, E_1^1, E_2^2, I_1)	$C_1^E < C^I < C_1^E$ $+ d_{10} S^*$ $< C^I + d_{10}S^*$ $< C_2^E + d_{10}S^*;$ $C_1^E + d_{10}S^* < C_2^E$	$F_1^E = C^I + d_{10}S^*$ $F_2^E = C_2^E$ $F^I = C_1^E + d_{10}S^*$	$B_1^E = d_1C_1^E - d_2C^I + S - d_7S^*$ $B_2^E = C_2^E + S$ $B^I = d_1C^I - d_2C_1^E + S - d_7S^*$ $F_{min}^I = d_1C^I - d_2C_1^E - d_7S^*$

Table 4-1--continued
Assumed Cost Relationships, Fees in Periods 1,...,∞ and Minimum Bids for Subsets of **S**

(1) (Subset of **S**)	(2) Assumed Cost Relationships	(3) Fees in Periods 1,...,∞	(4) Minimum Bids
(R_5, E_1^1, E_2^2, I_2)	$C_1^E < C_1^E + d_{10} S^* < C^I < C^I + d_{10} S^* < C_2^E + d_{10} S^*$; $C_1^E + d_{10} S^* < C_2^E$	$F_1^E = C^I + d_{10} S^*$ $F_2^E = C_2^E$ $F^I = C^I$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$ $B_2^E = C_2^E + S$ $B^I = C^I + S$ $F_{min}^I = C^I$
(R_6, E_1^1, E_1^2, I_1)	$C_1^E = C^I < C_2^E < C_1^E + d_{10} S^* = C^I + d_{10} S^* < C_2^E + d_{10} S^*$	$F_1^E = C^I + d_{10} S^*$ $F_2^E = C_1^E + d_{10} S^*$ $F^I = C_1^E + d_{10} S^*$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$ $B_2^E = d_1 C_2^E - d_2 C_1^E + S - d_7 S^*$ $B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$ $F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$
(R_6, E_1^1, E_2^2, I_1)	$C_1^E = C^I < C_1^E + d_{10} S^* = C^I + d_{10} S^* < C_2^E < C_2^E + d_{10} S^*$	$F_1^E = C^I + d_{10} S^*$ $F_2^E = C_2^E$ $F^I = C_1^E + d_{10} S^*$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$ $B_2^E = C_2^E + S$ $B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$ $F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$
(R_7, E_1^1, E_1^2, I_1)	$C^I < C_1^E < C_2^E < C^I + d_{10} S^* < C_1^E + d_{10} S^* < C_2^E + d_{10} S^*$	$F_1^E = C^I + d_{10} S^*$ $F_2^E = C^I + d_{10} S^*$ $F^I = C_1^E + d_{10} S^*$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$ $B_2^E = d_1 C_2^E - d_2 C^I + S - d_7 S^*$ $B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$ $F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$
(R_7, E_1^1, E_2^2, I_1)	$C^I < C_1^E < C^I + d_{10} S^* < C_1^E + d_{10} S^* < C_2^E + d_{10} S^*$; $C^I + d_{10} S^* < C_2^E$	$F_1^E = C^I + d_{10} S^*$ $F_2^E = C_2^E$ $F^I = C_1^E + d_{10} S^*$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$ $B_2^E = C_2^E + S$ $B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$ $F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$

Table 4-1--continued
Assumed Cost Relationships, Fees in Periods 1,...,∞ and Minimum Bids for Subsets of **S**

(1)	(2)	(3)	(4)
(Subset of **S**)	Assumed Cost Relationships	Fees in Periods 1,...,∞	Minimum Bids
(R_7, E_2^1, E_2^2, I_1)	$C^I < C^I + d_{10} S^*$	$F_1^E = C_1^E$	$B_1^E = C_1^E + S$
	$< C_1^E < C_1^E + d_{10} S^*$	$F_2^E = C_2^E$	$B_2^E = C_2^E + S$
	$< C_2^E + d_{10} S^*;$	$F^I = C_1^E + d_{10} S^*$	$B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$
	$C^I + d_{10} S^* < C_2^E$		$F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$
(R_8, E_1^1, E_1^2, I_1)	$C^I < C_1^E = C_2^E$	$F_1^E = C^I + d_{10} S^*$	$B_1^E = d_1 C_1^E - d_2 C^I + S - d_7 S^*$
	$< C^I + d_{10} S^*$	$F_2^E = C^I + d_{10} S^*$	$B_2^E = d_1 C_2^E - d_2 C^I + S - d_7 S^*$
	$< C_1^E + d_{10} S^*$	$F^I = C_1^E + d_{10} S^*$	$B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$
	$= C_2^E + d_{10} S^*$		$F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$
(R_8, E_2^1, E_2^2, I_1)	$C^I < C^I + d_{10} S^*$	$F_1^E = C_1^E$	$B_1^E = C_1^E + S$
	$< C_1^E = C_2^E$	$F_2^E = C_2^E$	$B_2^E = C_2^E + S$
	$< C_1^E + d_{10} S^*$	$F^I = C_1^E + d_{10} S^*$	$B^I = d_1 C^I - d_2 C_1^E + S - d_7 S^*$
	$= C_2^E + d_{10} S^*$		$F_{min}^I = d_1 C^I - d_2 C_1^E - d_7 S^*$

Table 4-2
Period 0 Fee, Fee in Periods 1,...,∞ and Cost Difference Regions for Subsets of **S**

(1)	(2)	(3)
Subset of **S** (a)Switching (b)Subset of θ	(a) Period 0 Fee (b) Fee in Periods 1,...,∞	Cost Difference Regions
$(R_1,E_1^1,E_1^2 I_1)$	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$\rho = 0$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$\alpha = 0$
(b) θ_1		$\gamma = 0$
(R_2,E_1^1,E_1^2,I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$\max[\gamma,\alpha] < \rho < d_{10}S^*$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$0 < \alpha < \min[\rho, d_{10}S^* - \gamma]$
(b) θ_1		$0 < \gamma < \min[\rho, d_{10}S^* - \alpha]$
(R_2,E_1^1,E_1^2,I_2)	(a)$B_1^{E^*} = C_2^E + d_{10}S^* - SW + \varepsilon$ (ii)	$\max[\gamma, \alpha, d_{10}S^*] < \rho < \gamma + d_{10}S^*)$
(a) Δ	or $B_1^{E^*} = d_1C^I - d_2C_2^E - d_7S^*$	$\max[0, d_{10}S^* - \gamma] < \alpha < \min[\rho, d_{10}S^*]$
(b) θ_3 and θ_4	$- SW - \varepsilon$ (iii)	$\max[0, \rho - d_{10}S^*, d_{10}S^* - \alpha] < \gamma < \rho$
	(b)$F_1^E = C_2^E + d_{10}S^*$	
(R_2,E_1^1,E_2^2,I_2)	(a)$B_1^{E^*} = C_2^E + d_{10}S^* - SW + \varepsilon$(ii)	$\max[\alpha, \gamma + d_{10}S^*] < \rho < m$
(a) Δ	or $B_1^{E^*} = d_1C^I - d_2C_2^E - d_7S^*$	$d_{10}S^* < \alpha < \rho$
(b) θ_3 and θ_4	$- SW - \varepsilon$ (iii)	$0 < \gamma < \rho - d_{10}S^*$
	(b) $F_1^E = C_2^E + d_{10}S^*$	
(R_3,E_1^1,E_1^2,I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$0 < \rho < d_{10}S^*; \rho = \gamma$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$\alpha = 0$
(b) θ_1		$0 < \gamma < d_{10}S^*; \gamma = \rho$

(i) This fee is as derived in equation 4.37.

(ii) This fee is as derived in equation 4.30.

(iii) This fee is as derived in equation 4.32.

Table 4-2--continued
Period 0 Fee, Fee in Periods 1,...,∞ and Cost Difference Regions for Subsets of **S**

(1)	(2)		(3)
Subset of **S** (a)Switching (b)Subset of θ	(a) Period 0 Fee (b) Fee in Periods 1,...,∞		Cost Difference Regions
(R_3, E_1^1, E_1^2, I_2)	(a) $B_1^{E^*} = C_2^E + S - d_7 S^*$	(i)	$\rho = \gamma;\ d_{10}S^* < \rho \leq m$
(a) Δ	(b) $F_1^E = C_2^E + d_{10}S^*$		$\alpha = 0$
(b) θ_2			$\gamma = \rho;\ d_{10}S^* < \gamma \leq m$
(R_4, E_1^1, E_1^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$	(ii)	$\rho = \gamma;\ 0 < \rho < d_{10}S^*$
(a) $\overline{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$\alpha = \rho;\ 0 < \alpha < d_{10}S^*$
(b) θ_1			$\gamma = 0$
(R_4, E_1^1, E_2^2, I_2)	(a) $B_1^{E^*} = d_1 C^I - d_2 C_2^E$		$\rho = \gamma;\ d_{10}S^* < \rho \leq m$
(a) Δ	$- d_7 S^* - SW - \varepsilon$	(iii)	$\alpha = \rho;\ d_{10}S^* < \alpha \leq m$
(b) θ_4 or θ_5	(b) $F_1^E = C_2^E + d_{10}S^*$		$\gamma = 0$
(R_5, E_1^1, E_1^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$	(ii)	$0 < \rho < \min[\alpha, d_{10}S^*]$
(a) $\overline{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$\max[\rho, -\gamma] < \alpha < d_{10}S^* - \gamma$
(b) θ_1			$-\alpha < \gamma < \min[0, d_{10}S^* - \alpha]$
(R_5, E_1^1, E_2^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$	(ii)	$\gamma + d_{10}S^* < \rho < d_{10}S^*$
(a) $\overline{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$d_{10}S^* < \alpha < d_{10}S^* - \gamma$
(b) θ_1			$-q - m < \gamma < \min[\rho - d_{10}S^*, d_{10}S^* - \alpha]$

(i) This fee is as derived in equation 4.31.

(ii) This fee is as derived in equation 4.37.

(iii) This fee is as derived in equation 4.32.

Table 4-2--continued
Period 0 Fee, Fee in Periods 1,...,∞ and Cost Difference Regions for Subsets of **S**

(1)	(2)		(3)
Subset of **S** (a)Switching (b)Subset of θ	(a) Period 0 Fee (b) Fee in Periods 1,...,∞		Cost Difference Regions
(R_5, E_1^1, E_2^2, I_2)	(a) $B_1^{E*} = C^I - d_7S^* - SW - \varepsilon$	(i)	$d_{10}S^* < \rho < \alpha$
(a) Δ	(b) $F_1^E = C^I + d_{10}S^*$		$\max[\rho,\ d_{10}S^* - \gamma] < \alpha \leq m$
(b) θ_5			$d_{10}S^* - \alpha < \gamma < 0$
(R_6, E_1^1, E_1^2, I_1)	(a) $F^{I*} = C_1^E + d_{10}S^*$	(ii)	$\rho = 0$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$\alpha = -\gamma;\ 0 < \alpha < d_{10}S^*$
(b) θ_1			$\gamma = -\alpha;\ -d_{10}S^* < \gamma < 0$
(R_6, E_1^1, E_2^2, I_1)	(a) $F^{I*} = C_1^E + d_{10}S^*$	(ii)	$\rho = 0$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$\alpha = -\gamma;\ d_{10}S^* < \alpha < m$
(b) θ_1			$\gamma = -\alpha;\ -q - m < \gamma < -d_{10}S^*$
(R_7, E_1^1, E_1^2, I_1)	(a) $F^{I*} = C_1^E + d_{10}S^*$	(ii)	$\max[\gamma,\ \alpha - d_{10}S^*] < \rho < 0$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$0 < \alpha < \min[-\gamma,\ \rho + d_{10}S^*]$
(b) θ_1			$-d_{10}S^* < \gamma < \min[\rho, -\alpha]$
(R_7, E_1^1, E_2^2, I_1)	(a) $F^{I*} = C_1^E + d_{10}S^*$	(ii)	$-d_{10}S^* < \rho < \min[0,\ \alpha - d_{10}S^*]$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$		$\max[-\gamma - d_{10}S^*,\ \rho + d_{10}S^*] < \alpha < -\gamma$
(b) θ_1			$-\alpha - d_{10}S^* < \gamma < \min[-\alpha,\ -d_{10}S^*]$

(i) This fee is as derived in equation 4.33.

(ii) This fee is as derived in equation 4.37.

Table 4-2--continued
Period 0 Fee, Fee in Periods 1,...,∞ and Cost Difference Regions for Subsets of **S**

(1)	(2)	(3)
Subset of **S** (a) Switching (b) Subset of θ	(a) Period 0 Fee (b) Fee in Periods 1,...,∞	Cost Difference Regions
(R_7, E_2^1, E_2^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$\gamma < \rho < -d_{10}S^*$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$0 < \alpha < -\gamma - d_{10}S^*$
(b) θ_1		$-q - m < \gamma < \min[\rho, -\alpha - d_{10}S^*]$
(R_8, E_1^1, E_1^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$\rho = \gamma$; $-d_{10}S^* < \rho < 0$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$\alpha = 0$
(b) θ_1		$\gamma = \rho$; $-d_{10}S^* < \gamma < 0$
(R_8, E_2^1, E_2^2, I_1)	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (i)	$\rho = \gamma$; $-q < \rho < -d_{10}S^*$
(a) $\bar{\Delta}$	(b) $F^I = C_1^E + d_{10}S^*$	$\alpha = 0$
(b) θ_1		$\gamma = \rho$; $-q - m < \gamma < -d_{10}S^*$

(i) This fee is as derived in equation 4.37.

Table 4-3
Period 0 Fee, Fee in Periods 1,...,∞ and Cost Difference Regions for Subsets of θ

(1)	(2)	(3)
(Subset of θ)	(a) Period 0 Fee (b) Fee in Periods 1,...,∞	Cost Difference Regions
θ_1	(a) $F^{I^*} = C_1^E + d_{10}S^*$ (b) $F^I = C_1^E + d_{10}S^*$	$-q \le \rho < d_{10}(S^* + \varepsilon)$ $0 \le \alpha \le m$ $-q - m \le \gamma \le d_{10}(S^* + \varepsilon)$
θ_2	(a) $B_1^{E^*} = C_2^E + S - d_7S^*$ (b) $F_1^E = C_2^E + d_{10}S^*$	$d_{10}(S^* + \varepsilon) < \rho \le m$ $\alpha = 0$ $d_{10}(S^* + \varepsilon) < \gamma \le m$
θ_3	(a) $B_1^{E^*} = C_2^E + d_{10}S^* + SW$ $+ \varepsilon$ (b) $F_1^E = C_2^E + d_{10}S^*$	$\alpha + d_{10}(S^* + \varepsilon) < \rho \le m$ $0 \le \alpha < \rho - d_{10}(S^* + \varepsilon)$ $d_{10}(S^* + \varepsilon) < \gamma < m$
θ_4	(a) $B_1^{E^*} = d_1C^I - d_2C_2^E$ $- d_7S^* - SW - \varepsilon$ (b) $F_1^E = C_2^E + d_{10}S^*$	$\max[\alpha, d_{10}(S^* + \varepsilon)] < \rho \le \alpha + d_{10}(S^* + \varepsilon)$ $\rho - d_{10}(S^* + \varepsilon) \le \alpha \le \rho$ $0 < \gamma < d_{10}(S^* + \varepsilon)$
θ_5	(a) $B_1^{E^*} = C^I - d_7S^*$ $- SW - \varepsilon$ (b) $F_1^E = C^I + d_{10}S^*$	$d_{10}(S^* + \varepsilon) < \rho \le \alpha$ $\rho < \alpha \le m$ $-m + q < \gamma \le 0$

CHAPTER 5
DERIVATION OF THE NO-SEARCH FEE AND THE NO-INVITATION FEE

Given the bids derived in Chapter 4, fee, market participant cost, market participant profit and resource expenditure outcomes for decision combinations other than A3, $\bar{A}3$ and $\bar{A}6$ were derived. The restatement of fee, market participant cost, market participant profit and resource expenditure outcomes for outcomes A3, $\bar{A}3$ and $\bar{A}6$ in terms of audit production costs (S, C_1^E, C_2^E and C^I), client costs (SC, SW and I) and the discount rate (r) requires derivation of the no-search fee in the AAMS ($F^I_{\bar{\sigma}A}$), the no-search fee in the BAMS ($F^I_{\bar{\sigma}\bar{A}}$) and the no-invitation fee in the BAMS ($F^I_{\bar{\iota}}$). The no-search fee in the AAM, the no-search fee in the BAM and the no-invitation fee in the BAM are derived in sections 5.1, 5.2 and 5.3, respectively. Section 5.4 summarizes Chapter 5.

5.1 Derivation of the No-search Fee Under the AAMS

$F^I_{\bar{\sigma}A}$ is derived by modeling the client's search decision to determine the client's expected cost of search [E($K^C_{\sigma A}$)] where costs include the fee in period 0, discounted future fees and non-fee costs (search costs, switching costs and invitation costs). The client compares the E($K^C_{\sigma A}$) to the discounted sum of costs the client incurs if the client does not search ($K^C_{\bar{\sigma}A}$) where $K^C_{\bar{\sigma}A}$ equals the incumbent's fee in period 0 plus the discounted sum of the incumbent's fees in periods 1,...,∞. If $K^C_{\bar{\sigma}A} < E(K^C_{\sigma A})$, the client does not search. As previously discussed in Chapter 3, the incumbent can set its fee such that $K^C_{\bar{\sigma}A}$ is slightly less than E($K^C_{\sigma A}$). When the incumbent chooses to sets it's fee at a no-search level, the incumbent sets it's no-search fee ($F^I_{\bar{\sigma}A}$) such that

$$K^C_{\bar{\sigma}A} = F^I_{\bar{\sigma}A} + d_2 F^I_{\bar{\sigma}A} = E(K^C_{\sigma A}) - \varepsilon.$$

Solving for $F^I_{\bar{\sigma}A}$,

$$d_1 F^{I}_{\bar{\sigma}A} = E(K^{C}_{\sigma A}) - \varepsilon .$$

Dividing through by d_1,

$$F^{I}_{\bar{\sigma}A} = d_{10}[E(K^{C}_{\sigma A})] - d_{10}\varepsilon . \tag{5.1}$$

5.1.1 Derivation of the Client's Expected Cost of Searching for Fee Information

The upper portion of figure 5-1 depicts portions of Figure 4-3 and describes client cost outcomes relevant to the client's decision to search when direct uninvited solicitation is allowed. The discounted sum of client costs in periods $0,\ldots,\infty$ for outcomes $A4(\theta_1)$ and $A5(\theta_2)$ - $A5(\theta_5)$ are taken directly from line 7 of Tables A-7 through A-11. Defining $\mathbf{A}^{CT}$ as the transpose of the vector of coefficients of ρ as described in the discounted sum of client costs in periods $0,\ldots,\infty$ for each θ_i,

$$\mathbf{A}^{CT} = [\,-d_1 \;\; -d_1 \;\; -d_1 \;\; 0 \;\; 0\,]. \tag{5.2}$$

Coefficients are in the order of θ. Defining $\mathbf{B}^{CT}$ as the transpose of the vector of coefficients for α_j in the discounted sum of client costs in periods $0,\ldots,\infty$ for each θ_i,

$$\mathbf{B}^{CT} = [\,0 \;\; 0 \;\; d_1 \;\; 0 \;\; 0\,]. \tag{5.3}$$

Defining ρ as the $(q + m + 1)$ X 1 matrix of ρ_i where $\rho_i = (-q,\ldots,m)$,

$$\rho = \begin{bmatrix} -q \\ \vdots \\ 0 \\ \vdots \\ m \end{bmatrix} \tag{5.4}$$

Defining α as the $(m + 1)$ X 1 matrix of α_j where $\alpha_j = (0,\ldots,m)$,

$$\alpha = \begin{bmatrix} 0 \\ 1 \\ \vdots \\ m \end{bmatrix} \tag{5.5}$$

Defining $\mathbf{P}_{\theta|\bar{\beta}}$ as the 5 X $(q + m + 1)$ matrix of the client and incumbent's identical assessments of the joint probability of ρ_i and θ_i when bidding does not occur,

$$\mathbf{P}_{\theta|\bar{\beta}} = \begin{bmatrix} \sum\limits_{\alpha_j=0}^{m} p(-q,\alpha_j,1|\bar{\beta}) & \cdots & \sum\limits_{\alpha_j=0}^{m} p(m,\alpha_j,1|\bar{\beta}) \\ p(-q,0,2|\bar{\beta}) & \cdots & p(m,0,2|\bar{\beta}) \\ \sum\limits_{\alpha_j=0}^{\rho-d_{10}(S^*+\varepsilon)-1} p(-q,\alpha_j,3|\bar{\beta}) & \cdots & \sum\limits_{\alpha_j=0}^{\rho-d_{10}(S^*+\varepsilon)-1} p(m,\alpha_j,3|\bar{\beta}) \\ \sum\limits_{\alpha_j=\rho-d_{10}(S^*+\varepsilon)-1}^{m} p(-q,\alpha_j,4|\bar{\beta}) & \cdots & \sum\limits_{\alpha_j=\rho-d_{10}(S^*+\varepsilon)-1}^{m} p(m,\alpha_j,4|\bar{\beta}) \\ \sum\limits_{\alpha_j=\rho+1}^{m} p(-q,\alpha_j,5|\bar{\beta}) & \cdots & \sum\limits_{\alpha_j=\rho+1}^{m} p(m,\alpha_j,5|\bar{\beta}) \end{bmatrix} \tag{5.6}$$

where

$$\sum_{\alpha_j=0}^{m} p(-q,\alpha_j,1|\bar{\beta})$$

is defined as the joint probability that $\rho = -q$ and $\theta = \theta_1$ when bidding does not occur. The sum of the 5 X (q + m + 1) elements of $\mathbf{P}_{\theta|\bar{\beta}}$ equals 1. Other probabilities in $\mathbf{P}_{\theta|\bar{\beta}}$ are similarly defined. For notational convenience, the joint probability of ρ_i and θ_i is hereafter defined as

$$\sum_{\alpha_j \in \theta_i} p(\rho_i,\alpha_j|\bar{\beta}).$$

The regions over which α_j are summed for all θ_i are the regions described on Table 4-3 and depicted on Figure 4-2. For example,

$$\sum_{\alpha_j=0}^{m} p(-q,\alpha_j,1|\bar{\beta}) \text{ is equivalent to } \sum_{\alpha_j \in \theta_1} p(-q,\alpha_j|\bar{\beta}).$$

Defining $Q_{\theta|\bar{\beta}}$ as the 5 X (m + 1) matrix of the client and incumbent's identical assessments of the joint probability of α_j and θ_i when bidding does not occur,

$$Q_{\theta|\bar{\beta}} = \begin{bmatrix} \sum\limits_{\rho_i=-q}^{d_{10}(S^*+\varepsilon)-1} p(\rho_i,0,1|\bar{\beta}) & \cdots & \sum\limits_{\rho_i=-q}^{d_{10}(S^*+\varepsilon)-1} p(\rho_i,m,1|\bar{\beta}) \\ \sum\limits_{\rho_i=d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,0,2|\bar{\beta}) & \cdots & \sum\limits_{\rho_i=d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,m,2|\bar{\beta}) \\ \sum\limits_{\rho_i=\alpha+d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,0,3|\bar{\beta}) & \cdots & \sum\limits_{\rho_i=\alpha+d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,m,3|\bar{\beta}) \\ \sum\limits_{\rho_i=\max[\alpha,d_{10}(S^*+\varepsilon)]+1}^{m} p(\rho_i,0,4|\bar{\beta}) & \cdots & \sum\limits_{\rho_i=\max[\alpha,d_{10}(S^*+\varepsilon)]+1}^{m} p(\rho_i,m,4|\bar{\beta}) \\ \sum\limits_{\rho_i=\rho+1}^{m} p(\rho_i,0,5|\bar{\beta}) & \cdots & \sum\limits_{\rho_i=\rho+1}^{m} p(\rho_i,m,5|\bar{\beta}) \end{bmatrix} \tag{5.7}$$

The regions over which ρ_i are summed for all θ_i are the regions described on Table 4-3 and depicted on Figure 4-3. The sum of the 5 X (m + 1) elements of $Q_{\theta|\bar{\beta}}$ equals 1. For notational convenience, the joint probability of α_j and θ_i is hereafter defined as

$$\sum_{\rho_i\in\theta_i} p(\rho_i,\alpha|\bar{\beta}).$$

For example,

$$\sum_{\rho_i=-q}^{d_{10}(S^*+\varepsilon)-1} p(\rho_i,0,1|\bar{\beta}),$$ the probability that $\alpha_j = 0$ and $\theta = 1$ given no bidding, is

equivalent to

$$\sum_{\rho_i\in\theta_1} p(\rho_i,0|\bar{\beta}).$$

Defining the transpose of $\mathbf{P}^{*}_{\theta|\bar{\beta}}$ as the (1X5) vector of the probabilities of θ_i,

$$\mathbf{P}^{*T}_{\theta|\bar{\beta}} = \Big[\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\bar{\beta}) \quad \sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\bar{\beta}) \quad \sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\bar{\beta})$$

$$\sum_{\rho_i\in\theta_4}\sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\bar{\beta}) \quad \sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\bar{\beta})\Big] \qquad (5.8)$$

where the sum of the elements of $\mathbf{P}^{*T}_{\theta|\bar{\beta}}$ equals 1. For simplicity, let

$\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\bar{\beta}),\ldots,\sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\bar{\beta})$ be defined as $P_{1|\bar{\beta}},\ldots, P_{5|\bar{\beta}}$.

Let $\mathbf{K}^{C}_{\beta A}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of client costs in periods 0,...,∞ for each θ_i when bidding does not occur in the AAMS, i. e.,

$$\mathbf{K}^{C}_{\beta A} = \begin{bmatrix} d_1C^{I} + S^{*} + SC \\ d_1C^{I} + S^{*} + SC + \varepsilon \\ d_1C^{I} + S^{*} + SC \\ d_1C^{I} + SC - \varepsilon \\ d_1C^{I} + SC - \varepsilon \end{bmatrix}. \qquad (5.9)$$

Combining the probability matrices with matrices describing the discounted sum of client costs in periods 0,...,∞, the client's expected cost of search is

$$E(K^{C}_{\sigma A}) = \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta A} \qquad (5.10)$$

5.1.2 Derived Solution of the No-Search Fee Under the AAMS and Restatement of Market Participant Costs, Profits and Resource Expenditures for Outcome A3

Substituting $E(K^{C}_{\sigma})$ from (5.10) into (5.1),

$$F^{I}_{\bar{\sigma}A} = d_{10}\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta A}\right] - d_{10}\varepsilon. \qquad (5.11)$$

Substituting $F^{I}_{\bar{\sigma}A}$ from (5.11) into market participant cost, profit and resource expenditure outcomes on Table 3-3, the restated cost, profit and resource expenditure outcomes for decision combination A3 are described in Appendix A on Table A-6.

5.2 Derivation of the No-search Fee Under the BAMS

The derivation of the no-search fee under the BAMS is identical to the derivation of the no-search fee under the AAMS. Subsequent to the client invitation to audit firms to submit bids and the unwillingness of these firms to incur bidding costs, the client's search decision is identical to the search decision under the AAMS. If the client searches and discovers bid relationships consistent with $\theta_2 - \theta_5$, the client switches and incurs costs as described on Figure 5-1 for $\bar{A}5(\theta_2) - \bar{A}5(\theta_5)$. If the client searches and discovers a bid relationship consistent with θ_1, the incumbent revises it's fee and the client's total cost is $d_1C^I - d_1\rho_i + S^* + SC$. Note that with the exception of removing invitation costs (I), the total discounted costs described for $\theta_1 - \theta_5$ on Figure 5-1 are identical to total discounted costs described on line 7 of Tables A-18 through A-22. The invitation cost is irrelevant in the client's search decision under the BAMS as this cost is sunk when the client makes the search decision. Thus, from equation 5.11,

$$F^{I}_{\bar{\sigma}\bar{A}} = F^{I}_{\bar{\sigma}A} = d_{10}\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\right] - d_{10}\varepsilon \qquad (5.12)$$

where $\mathbf{K}^{C}_{\bar{\beta}\bar{A}} = \mathbf{K}^{C}_{\bar{\beta}A}$.

Substituting $F^{I}_{\bar{\sigma}\bar{A}}$ from equation (5.12) into market participant cost, profit and resource expenditure outcomes for decision combinations À3 as described on Table 3-8, the restated cost, profit and resource expenditure outcomes are described in Appendix A on Table A-17.

5.3 Derivation of the No-invitation Fee Under the AAMS

F^{I}_{ι} is derived by modeling the client's invitation decision to determine the client's expected cost of invitation $E(K^{C}_{\iota})$ where costs include the fee in period 0, discounted future fees and non-fee costs (search costs, switching costs and invitation costs). The client compares the $E(K^{C}_{\iota})$ to the discounted sum of costs the client incurs if the client does not invite ($K^{C}_{\bar{\iota}}$) where $K^{C}_{\bar{\iota}}$ equals the incumbent's fee in period 0 plus the discounted sum of the incumbent's fees in periods 1,...,∞. If $K^{C}_{\bar{\iota}} < E(K^{C}_{\iota})$, the client does not invite. As previously discussed in Chapter 3, the incumbent can set its fee such that $K_{\bar{\iota}}^{C}$ is slightly less than $E(K_{\iota}^{C})$. When the incumbent chooses to sets it's fee at a no-invitation level, the incumbent sets it's no-invitation fee ($F_{\bar{\iota}}^{I}$) such that

$$K_{\bar{\iota}}^{C} = F_{\bar{\iota}}^{I} + d_2 F_{\bar{\iota}}^{I} = E(K_{\iota}^{C}) - \varepsilon.$$

Solving for $F_{\bar{\iota}}^{I}$,

$$d_1 F_{\bar{\iota}}^{I} = [E(K_{\iota}^{C})] - \varepsilon.$$

Dividing through by d_1,

$$F_{\bar{\iota}}^{I} = d_{10}[E(K_{\iota}^{C})] - d_{10}\varepsilon. \tag{5.13}$$

5.3.1 Derivation of the Client's Expected Cost of Inviting Entrants to Bid

Figure 5-2 depicts portions of Figure 4-3 related to the invitation decision and describes client cost outcomes relevant to the client's decision to invite when direct uninvited solicitation is banned. The discounted sum of client costs in periods 0,...,∞ for outcomes $\bar{A}1(\theta_2)$ - $\bar{A}(\theta_5)$ and $\bar{A}2(\theta_1)$ are taken from line 7 of Tables A-12 through A-16. The discounted sum of client costs in periods 0,...,∞ for outcomes $\bar{A}4(\theta_1)$ and $\bar{A}5(\theta_2)$- $\bar{A}5(\theta_5)$ are taken from line 7 of Tables A-18 through A-22. The discounted sum of client costs in periods 0,...,∞ for outcome $\bar{A}3$ is from line 7 of Table A-16.

If the client invites bidding and entrants do not bid, the client is faced with the decision of whether or not to search. In solving for the client's expected cost of inviting entrants to bid, it can be shown that the difference between assuming that search does or does not occur if entrants do not bid is equal to ε, a very small amount. If the derivation of $E(K_{\iota}^{C})$ assumes no search, $\bar{A}3$ occurs and the client's total discounted costs equal

$$d_1 F_{\bar{\sigma}\bar{A}}^{I} + I = \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}\bar{A}}^{C} - \varepsilon + I \tag{5.14}$$

If the derivation of $E(K^{C}_{\iota})$ assumes search, the client's expected outcome is the sum of discounted costs for $\overline{A}4$ and $\overline{A}5(\theta_2)$- $\overline{A}5(\theta_5)$ weighted by respective probabilities, i.e., $E(K^{C}_{\bar{\sigma}A})$. Let $\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of client costs in periods $0,\ldots,\infty$ for each θ_i when bidding does not occur in the BAMS subsequent to invitation, i. e.,

$$\mathbf{K}^{C}_{\bar{\beta}\bar{A}} = \begin{bmatrix} d_1C^I + S^* + SC + I \\ d_1C^I + S^* + SC + I + \varepsilon \\ d_1C^I + S^* + SC + I \\ d_1C^I + SC + I - \varepsilon \\ d_1C^I + SC + I - \varepsilon \end{bmatrix}. \tag{5.15}$$

Combining probabilities and outcomes,

$$E(K^{C}_{\bar{\sigma}A}) = \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}} \tag{5.16}$$

As the difference in (5.14) and (5.16) equals ε, a very small amount, the derivation of $E(K^{C}_{\iota})$ assumes that the incumbent sets it's fee such that the client's cost-minimizing decision is to search for fee information. Thus, the derivation of $E(K^{C}_{\iota})$ ignores outcome $\overline{A}3$. Given this

$$E(K^{C}_{\iota}) = p(\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\right]$$

$$+p(\bar{\beta})\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\right] \tag{5.17}$$

where previously undefined terms are defined as follows. Defining $\mathbf{P}_{\theta|\beta}$ as the 5 X (q + m + 1) matrix of the client and incumbent's identical assessments of the joint probability of ρ_i and θ_i when bidding occurs,

$$\mathbf{P}_{\theta|\beta} = \begin{bmatrix} \sum\limits_{\alpha_j=0}^{m} p(-q,\alpha_j,1|\beta) & \cdots & \sum\limits_{\alpha_j=0}^{m} p(m,\alpha_j,1|\beta) \\ p(-q,0,2|\beta) & \cdots & p(m,0,2|\beta) \\ \sum\limits_{\alpha_j=0}^{\rho-d_{10}(S^*+\varepsilon)-1} p(-q,\alpha_j,3|\beta) & \cdots & \sum\limits_{\alpha_j=0}^{\rho-d_{10}(S^*+\varepsilon)-1} p(m,\alpha_j,3|\beta) \\ \sum\limits_{\alpha_j=\rho-d_{10}(S^*+\varepsilon)-1}^{m} p(-q,\alpha_j,4|\beta) & \cdots & \sum\limits_{\alpha_j=\rho-d_{10}(S^*+\varepsilon)-1}^{m} p(m,\alpha_j,4|\beta) \\ \sum\limits_{\alpha_j=\rho+1}^{m} p(-q,\alpha_j,5|\beta) & \cdots & \sum\limits_{\alpha_j=\rho+1}^{m} p(m,\alpha_j,5|\beta) \end{bmatrix} \tag{5.18}$$

where

$$\sum_{\alpha_j=0}^{m} p(-q,\alpha_j,1|\beta)$$

is defined as the joint probability that $\rho = -q$ and $\theta = \theta_1$ when bidding occurs. The sum of the 5 X (q + m + 1) elements of $\mathbf{P}_{\theta|\beta}$ equals 1. Other probabilities in $\mathbf{P}_{\theta|\beta}$ are similarly defined. For notational convenience, the joint probability of ρ_i and θ_i is hereafter defined as

$$\sum_{\alpha_j \in \theta_i} p(\rho_i,\alpha_j|\beta).$$

Define $\mathbf{Q}_{\theta|\beta}$ as the 5 X (m + 1) matrix of the client and incumbent's identical assessments of the joint probability of α_j and θ_i when bidding occurs, i.e.,

$$\mathbf{Q}_{\theta|\beta} = \begin{bmatrix} \sum\limits_{\rho_i=-q}^{d_{10}(S^*+\varepsilon)-1} p(\rho_i,0,1|\beta) & \cdots & \sum\limits_{\rho_i=-q}^{d_{10}(S^*+\varepsilon)-1} p(\rho_i,m,1|\beta) \\ \sum\limits_{\rho_i=d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,0,2|\beta) & \cdots & \sum\limits_{\rho_i=d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,m,2|\beta) \\ \sum\limits_{\rho_i=\alpha+d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,0,3|\beta) & \cdots & \sum\limits_{\rho_i=\alpha+d_{10}(S^*+\varepsilon)+1}^{m} p(\rho_i,m,3|\beta) \\ \sum\limits_{\rho_i=\max[\alpha,d_{10}(S^*+\varepsilon)]+1}^{m} p(\rho_i,0,4|\beta) & \cdots & \sum\limits_{\rho_i=\max[\alpha,d_{10}(S^*+\varepsilon)]+1}^{m} p(\rho_i,m,4|\beta) \\ \sum\limits_{\rho_i=\rho+1}^{m} p(\rho_i,0,5|\beta) & \cdots & \sum\limits_{\rho_i=\rho+1}^{m} p(\rho_i,m,5|\beta) \end{bmatrix} \quad (5.19)$$

The regions over which ρ_i are summed for all θ_i are the regions described on Table 4-3 and depicted on Figure 4-3. The sum of the 5 X (m + 1) elements of $\mathbf{Q}_{\theta|\beta}$ equals 1. For notational convenience, the joint probability of α_j and θ_i is hereafter defined as

$$\sum_{\rho_i\in\theta_i} p(\rho_i,\alpha|\beta).$$

Defining the transpose of $\mathbf{P}^*_{\theta|\beta}$ as the (1X5) vector of the probabilities of θ_i,

$$\mathbf{P}^{*T}_{\theta|\beta} = \Big[\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\beta) \quad \sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta) \quad \sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta) \quad \sum_{\rho_i\in\theta_4}\sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\beta) \quad \sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\beta)\Big] \quad (5.20)$$

where the sum of the elements of $\mathbf{P}^{*T}_{\theta|\beta}$ equals 1.

For simplicity, let

$$\sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\beta), \ldots, \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\beta) \text{ be defined as } P_{1|\beta}, \ldots, P_{5|\beta}.$$

Let $K^C_{\beta\bar{A}}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of client costs in periods 0,...,∞ for each θ_i when bidding occurs in the BAMS, i. e.,

$$K^C_{\beta\bar{A}} = \begin{bmatrix} d_1C^I + S^* + I \\ d_1C^I + S^* + I + \varepsilon \\ d_1C^I + S^* + I \\ d_1C^I + I - \varepsilon \\ d_1C^I + I - \varepsilon \end{bmatrix}. \tag{5.21}$$

5.3.2 Derived Solution of the No-Invitation Fee Under the BAMS and Restatement of Market Participant Costs, Profits and Resource Expenditures for the No-Invitation Outcome

Substituting $E(K^C_\iota)$ from (5.16) into (5.13),

$$F^I_{\bar{\iota}} = d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^C_{\beta\bar{A}}\Big]$$

$$+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^C_{\bar{\beta}\bar{A}}\Big]\Big\} - d_{10}\varepsilon. \tag{5.22}$$

Substituting $F^I_{\bar{\iota}}$ from (5.22) into market participant costs, profits and resource expenditures on Table 3-11, the restated costs, profits and resource expenditures are described on Table A-23.

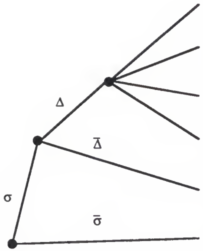
5.4 Summary of Chapter 5

Solutions of the fee, market participant cost, market participant profit and resource expenditure outcomes for decision combinations A3, $\bar{A}3$ and $\bar{A}6$ as described on Tables 3-3, 3-8 and 3-11, respectively, require derivations of the no-search fee in the AAM, the no-search fee in the BAM and the no-invitation fee in the BAM. These fees are derived in this chapter. The no-search fee is set by the incumbent at an amount slightly less than the client's expected cost of searching for fee information. Outcomes for A3 and $\bar{A}3$ are restated in terms of audit production costs, non-fee client costs, the discount rate and the client's assessments of ρ and α. These restated outcomes are described in Appendix A on Tables A-6 and A-17.

The no-invitation fee is set by the incumbent at an amount slightly less than the client's expected cost of inviting entrants to bid. Outcomes for $\bar{A}6$ are restated in terms of audit production costs, non-fee client costs, the discount rate, the client's assessments of ρ and α and the client's assessment of the probability that one or more entrants will bid subsequent to invitation. Restated outcomes for $\bar{A}6$ are described in Appendix A on Table A-23.

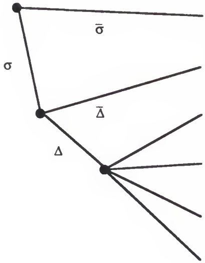
These derivations of decision combination outcomes for decision combinations A3, $\bar{A}3$ and $\bar{A}6$ along with derivations of outcomes for decision-cost combinations $A1(\theta_2)$ - $A1(\theta_5)$, $A2(\theta_1)$, $A4(\theta_1)$, $A5(\theta_2)$ - $A5(\theta_5)$, $\bar{A}1(\theta_2)$ - $\bar{A}1(\theta_5)$, $\bar{A}2(\theta_1)$, $\bar{A}4(\theta_1)$ and $\bar{A}5(\theta_2)$ - $\bar{A}5(\theta_5)$, as derived in Chapter 4, comprise the set of fee, cost, profit and resource expenditure outcome solutions for the BAM and the AAM. Given these outcome solutions, the results of comparisons between fees, profits, client costs and resource expenditures of the BAM and the AAM are described in Chapter 6.

Client Costs Relevant to the Search Decision: AAM



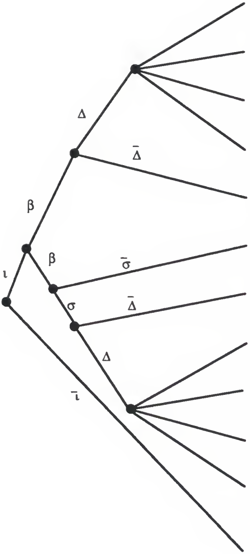
Outcome	Discounted Sum of Client Costs in Periods 0,...,∞
A5(θ_2)	$d_1C^I - d_1\rho_i + S^* + SC + \varepsilon$
A5(θ_3)	$d_1C^I - d_1\rho_i + d_1\alpha_j + S^* + SC$
A5(θ_4)	$d_1C^I + SC - \varepsilon$
A5(θ_5)	$d_1C^I + SC - \varepsilon$
A4(θ_1)	$d_1C^I - d_1\rho_i + S^* + SC$
A3	$\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\bar{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}A}$

Client Costs Relevant to the Search Decision: BAM



$\bar{A}3$	$\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\bar{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{\bar{A}}}$
$\bar{A}4(\theta_1)$	$d_1C^I - d_1\rho_i + S^* + SC$
$\bar{A}5(\theta_5)$	$d_1C^I + SC - \varepsilon$
$\bar{A}5(\theta_4)$	$d_1C^I + SC - \varepsilon$
$\bar{A}5(\theta_3)$	$d_1C^I - d_1\rho_i + d_1\alpha_j + S^* + SC$
$\bar{A}5(\theta_2)$	$d_1C^I - d_1\rho_i + S^* + SC + \varepsilon$

Figure 5-1
Client Costs Relevant to the Search Decision



Outcome	Discounted Sum of Client Costs in Periods 0,...,∞
$\bar{A}1(\theta_2)$	$d_1C^I - d_1\rho_i + S^* + \varepsilon + I$
$\bar{A}1(\theta_3)$	$d_1C^I - d_1\rho_i + d_1\alpha_i + S^* + I$
$\bar{A}1(\theta_4)$	$d_1C^I + I - \varepsilon$
$\bar{A}1(\theta_5)$	$d_1C^I + I - \varepsilon$
$\bar{A}2(\theta_1)$	$d_1C^I - d_1\rho_i + S^* + I$
$\bar{A}3$	$\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\bar{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}} - \varepsilon$
$\bar{A}4(\theta_1)$	$d_1C^I - d_1\rho_i + S^* + SC + I$
$\bar{A}5(\theta_2)$	$d_1C^I - d_1\rho_i + S^* + SC + I + \varepsilon$
$\bar{A}5(\theta_3)$	$d_1C^I - d_1\rho_i + d_1\alpha_i + S^* + SC + I$
$\bar{A}5(\theta_4)$	$d_1C^I + SC + I - \varepsilon$
$\bar{A}5(\theta_5)$	$d_1C^I + SC + I - \varepsilon$
$\bar{A}6$	$p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\beta}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\beta}\mathbf{K}^{C}_{\beta\bar{A}}]\ +$ $p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\beta}\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}] - \varepsilon$

Figure 5-2
Client Costs Relevant to the Invitation Decision: BAM

CHAPTER 6

COMPARISON OF FEE, MARKET PARTICIPANT COST, PROFIT AND RESOURCE EXPENDITURE OUTCOMES BETWEEN THE BAMS AND THE AAMS

In Chapters 3-5, the set of possible fee, market participant cost, market participant profit and resource expenditure outcomes were derived for all ρ_i ,α_j and γ_{i-j} for both the AAMS and the BAMS. Outcomes are derived in terms of audit production costs (C^I, C_1^E, S and C_2^E), other audit firm costs (G), non-fee client costs (SW, SC and I) and the beliefs of the client and incumbent regarding the ρ_i and α_j and the likelihood of the various outcomes. This chapter describes differences in fee, market participant cost, market participant profit and resource expenditure outcomes for the set of possible comparisons between the AAMS and the BAMS. Fee, market participant cost, market participant profit and resource expenditure outcomes for the AAMS are described in Tables A-1 through A-11 in Appendix A for decision-cost combinations $A1(\theta_2)$-$A1(\theta_5)$, $A2(\theta_1)$, A3, $A4(\theta_1)$ and $A5(\theta_2)$-$A5(\theta_5)$. Fee, market participant cost, market participant profit and resource expenditure outcomes for the BAMS are described in Tables A-12 through A-23 in Appendix A for outcomes $\bar{A}1(\theta_2)$- $\bar{A}1(\theta_5)$, $\bar{A}2(\theta_1)$, $\bar{A}3$, $\bar{A}4(\theta_1)$, $\bar{A}5(\theta_2)$- $\bar{A}5(\theta_5)$ and $\bar{A}6$. To simplify the presentation of differences in outcomes, the set of comparisons between the BAMS and the AAMS is divided into the following three categories:

(1) Category 1 is the set of comparisons assuming invitation occurs in the BAM.

(2) Category 2 is the set of comparisons assuming that invitation does not occur in the BAM and that search occurs in the AAM when entrants do not bid, i.e., decision combination $\bar{A}6$ is compared to AAM decision combinations other than A3.

(3) Category 3 is the set of comparisons assuming invitation does not occur in the BAM, entrants do not bid and clients do not search in the AAM, i.e., outcomes for decision combinations $\bar{A}6$ and A3 are compared.

Prior to describing differences in outcomes of decision-cost combinations of the AAMS and the BAMS, conditions under which clients search for fee information in the AAM and the BAM are derived in sections 6.1 and 6.2. Conditions under which clients invite one or more entrants to bid when direct uninvited solicitation is banned are derived in section 6.3. Sections 6.4, 6.5 and 6.6 describe category 1,2 and 3 comparisons of decision-cost combinations for the AAMS and the BAMS. Sections 6.7-6.11 summarize Chapter 6 results.

6.1 Client's Search Decision and the Incumbent's Fee-setting Decision Prior to Search:AAMS

As previously discussed, the client's decision to search for fee information when bidding does not occur in the allowed audit market depends, in part, upon the fee charged by the incumbent audit firm. If the incumbent audit firm sets its fee such that the client's expected cost of searching for fee information, $E(K^{C}_{\sigma})$, exceeds the client's cost of not searching, $K^{C}_{\bar{\sigma}}$, the client will not search. Pricing by the incumbent firm when entrants do not bid and direct uninvited solicitation is allowed depends upon the incumbent's assessment of the state probabilities relative to the client's assessment of state probabilities. This research assumes that the incumbent's and the client's distributions of beliefs regarding differences in the production costs of audit firms are identical. The conditions required for search or no search to occur are derived by modeling the incumbent's fee setting decision prior to client search.

The incumbent's profit-maximizing decision is to set fees at a no-search level if the following two conditions hold:

(i) The incumbent's profit given no-search, $\pi^{I}_{\bar{\sigma}}$, exceeds the incumbent's expected profit, $E(\pi^{I}_{\sigma A})$, given search, i.e.,

$$\pi^{I}_{\bar{\sigma}} > E(\pi^{I}_{\sigma A}), \text{ where} \tag{6.1}$$

$$\pi^{I}_{\bar{\sigma}} = F^{I}_{\bar{\sigma}A} - C^{I} + d_2(F^{I}_{\bar{\sigma}A} - C^{I})$$

$$= d_1 (F^{I}_{\bar{\sigma}A} - C^{I}).$$

(ii) $\pi^{I}_{\bar{\sigma}} \geq 0.$ (6.2)

Substituting the derived value of $d_1 (F^{I}_{\bar{\sigma}A} - C^{I})$ from line 11 of Table A-6, condition (i) as stated in (6.1) is written as

$$\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta A} - \varepsilon - d_1 C^{I} > E(\pi^{I}_{\bar{\sigma}A}) \text{ and} \tag{6.3}$$

condition (ii) as stated in (6.2) is written as

$$\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta A} - \varepsilon - d_1 C^{I} \geq 0. \tag{6.4}$$

Algebraic rearrangement of terms, described in Section B.1 of Appendix B, yields a restatement of condition (ii) as follows:

$$E(\rho|\bar{\beta}) < d_{10} S^{*} + d_{10} SC + \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j|\bar{\beta})(z_j) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j|\bar{\beta})(z_j)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta})\alpha_j - d_{10}\varepsilon\ (1 - P_{2|\bar{\beta}}) \text{ where} \tag{6.5}$$

$z_i \equiv$ the amount by which ρ exceeds $d_{10}\ (S^{*} + \varepsilon)$, i.e,

$$z_i = \rho_i - d_{10}\ (S^{*} + \varepsilon).$$

For notational convenience, let

$$\lambda|\bar{\beta} = \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j|\bar{\beta})(z_j) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j|\bar{\beta})(z_j)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta})\alpha_j - d_{10}\varepsilon\ (1 - P_{2|\bar{\beta}}) \tag{6.6}$$

Substitution of $\lambda|\beta$ into (6.5) yields

$$E(\rho|\beta) < d_{10}\, S^* + d_{10}\, SC + \lambda|\beta \qquad (6.7)$$

Condition (i) is restated given the derived value of $E(\pi^I_{\sigma A})$ The upper portion of Figure 6-1 depicts portions of Figure 4-3 and describes incumbent profit outcomes relevant to the incumbent's fee setting decision prior to search when direct uninvited solicitation is allowed. The discounted sum of incumbent profits for periods $0,\ldots,\infty$ for decision-cost combination $A4(\theta_1)$ is as described on line 11 of Table A-7. The incumbent's profits in periods $0,\ldots,\infty$ are zero for decision-cost combinations $A5(\theta_2)$- $A5(\theta_5)$ as described on line 12 of Tables A-8 through A-11. Defining $\mathbf{A}^{IT}$ as the transpose of the vector of coefficients of ρ as described in the discounted sum of the incumbent's profits in periods $0,\ldots,\infty$ for each θ_i when bidding does not occur in the AAMS and the client searches for fee information,

$$\mathbf{A}^{IT} = [\, -d_1 \quad 0 \quad 0 \quad 0 \quad 0\,]. \qquad (6.8)$$

Coefficients are in the order of θ. Let $\mathbf{K}^I_{\beta A}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of the incumbent's profits for periods $0,\ldots,\infty$ for each θ_i when bidding does not occur in the AAMSand the client searches for fee information, i.e.,

$$\mathbf{K}^I_{\beta A} = \begin{bmatrix} S^* \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}. \qquad (6.9)$$

Combining the probability matrices with matrices describing the discounted sum of the incumbent's profits in periods $0,\ldots,\infty$, the incumbent's expected profit given search is

$$E(\pi^{I}_{\sigma A}) = \mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\beta A} \tag{6.10}$$

where $\mathbf{P}_{\theta|\bar{\beta}}$, ρ and $\mathbf{P}^{*T}_{\theta|\bar{\beta}}$ are as previously defined in equations (5.6), (5.4), and (5.8), respectively. Substituting the derived value of $E(\pi^{I}_{\sigma A})$ in equation (6.10) into equation (6.3), condition (i) is rewritten as

$$\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\beta A} < \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta A} - \varepsilon - d_1 C^{I} \tag{6.11}$$

Algebraic rearrangement of terms, described in Section B.2 of Appendix B, yields a restatement of condition (i) as follows:

$$\begin{aligned} E(\rho|\bar{\beta}) < {} & d_{10}\, S^{*} + d_{10}\, SC - \sum_{\rho_i \in \theta_1}\sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\bar{\beta})(x_j) \\ & + \sum_{\rho_i \in \theta_4}\sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\bar{\beta})(z_j) + \sum_{\rho_i \in \theta_5}\sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\bar{\beta})(z_j) \\ & + \sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta})\alpha_j - d_{10}\,\varepsilon\,(1 - P_{2|\bar{\beta}}) + \varepsilon\, P_{1|\bar{\beta}} \text{ where} \end{aligned} \tag{6.12}$$

$x_j \equiv$ the amount by which $d_{10}\,(S^{*}+\varepsilon)$ exceeds ρ when $\rho_i \in \theta_1$, i.e,

$x_j = d_{10}\,(S^{*}+\varepsilon) - \rho_i$.

From equation (6.6), substitute $\lambda|\bar{\beta}$ for

$$\begin{aligned} & \sum_{\rho_i \in \theta_4}\sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\bar{\beta})(z_j) + \sum_{\rho_i \in \theta_5}\sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\bar{\beta})(z_j) \\ & + \sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta})\alpha_j - d_{10}\,\varepsilon\,(1 - P_{2|\bar{\beta}}) \,. \end{aligned}$$

Equation (6.12) is rewritten as

$$E(\rho|\bar{\beta}) < d_{10}\, S^{*} + d_{10}\, SC + \lambda|\bar{\beta} - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\bar{\beta})(x_i)$$

$$+ \varepsilon\, P_{1|\bar{\beta}} \tag{6.13}$$

Comparing condition (i) as stated in (6.13) with condition (ii) as stated in (6.7), condition (i) is seen to be stronger than condition (ii). Thus if condition (i) holds, the incumbent sets its fee at $F^{I}_{\bar{\sigma}A}$ and the client does not search. Condition (i) may also be stated in terms of search costs (SC) as

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j}$$

$$+ \varepsilon\, (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon. \tag{6.14}$$

The derivation of this restatement of condition (i) is described in Section B.3 of Appendix B. Several observations regarding the likelihood of satisfaction of the no-search condition follow given the restated condition in (6.14). First of all, as search costs are assumed to be non-trivial amounts, the incumbent always sets it's fee at a no-search level when $P_{2|\bar{\beta}} = P_{3|\bar{\beta}} = 0$. Given the nature of θ_2 and θ_3, it does not seem unlikely that these probabilities will equal or tend towards 0. First of all, $P_{3|\bar{\beta}}$, $P_{4|\bar{\beta}}$ and $P_{5|\bar{\beta}}$ should be relatively low compared to $P_{1|\bar{\beta}}$ and $P_{2|\bar{\beta}}$ when bidding does not occur as entrant 1 has the opportunity to bid profitably when cost differences lie in θ_3-θ_5. Second, as seen in Table 4-5, θ_2 and θ_3 occur where both entrant 1 and entrant 2's costs of production are lower than the incumbent's by at least $d_{10}\,(S^{*} + \varepsilon)$. θ_2 also requires that production costs of entrant 1 and entrant 2 be identical. Thus search occurs only when the client's and incumbent's assessments of the likelihood of θ_2 and θ_3 are high enough for failure of condition (i).

6.2 Client's Search Decision and the Incumbent's Fee-setting Decision Prior to Search:Bams

Once invitation has occurred in the BAM, there is no difference in the decisions of market participants. As seen in Figure 6-1, the discounted sum of incumbent profits in periods $0,\ldots,\infty$ are the same under the BAM and the AAM. Thus, the no-search condition as stated in (6.12) and (6.14) holds for both the BAM and the AAM.

6.3 Client's Invitation Decision and the Incumbent's Fee-setting Decision Prior to Invitation

As previously discussed, the client's decision to invite one or more entrants to bid when direct uninvited solicitation is banned depends, in part, upon the fee charged by the incumbent audit firm. If the incumbent audit firm sets its fee such that the client's expected cost of inviting , $E(K^C_{\iota})$, exceeds the client's cost of not inviting, $K^C_{\bar{\iota}}$, the client will not invite.

The incumbent's profit-maximizing decision is to set fees at a no-invitation level if the following two conditions hold:

(a) The incumbent's profit given no-invitation, $\pi^I_{\bar{\iota}}$, exceeds the incumbent's expected profit given invitation, $E(\pi^I_{\iota})$, i.e.,

$$\pi^I_{\bar{\iota}} > E(\pi^I_{\iota}) \text{ , where} \tag{6.15}$$

$$\pi^I_{\bar{\iota}} = F^I_{\bar{\iota}} - C^I + d_2(F^I_{\bar{\iota}} - C^I)$$

$$= d_1 (F^I_{\bar{\iota}} - C^I).$$

(b) $\pi^I_{\bar{\iota}} \geq 0.$ (6.16)

Substituting the derived value of $d_1 (F^I_{\bar{\iota}} - C^I)$ from line 11 of Table A-23, condition (b) as stated in (6.16) is written as

$$p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\hat{A}}\Big]$$

$$+p(\bar{\beta})\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta\bar{A}}\right] - \varepsilon - d_1 C^I \geq 0 \qquad (6.17)$$

Algebraic rearrangement of terms, described in Section B.4 of Appendix B, yields a restatement of condition (b) as follows:

$$E(\rho) < d_{10} S^* + d_{10} I + p(\bar{\beta})\, d_{10} SC$$

$$+ \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)(z_i) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)(z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)\alpha_j - d_{10}\,\varepsilon\,(1 - P_2) \text{ where} \qquad (6.18)$$

$z_i \equiv$ the amount by which ρ exceeds $d_{10}\ (S^* + \varepsilon)$, i.e,

$z_i = \rho_i - d_{10}\ (S^* + \varepsilon)$.

For notational convenience, let

$$\lambda = \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)(z_i) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)(z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)\alpha_j - d_{10}\,\varepsilon\,(1 - P_2) \qquad (6.19)$$

Substitution of λ into (6.18) yields

$$E(\rho) < d_{10} S^* + d_{10} I + p(\bar{\beta})\, d_{10} SC + \lambda \qquad (6.20)$$

Condition (a) is solved for given the derived value of $E(\pi_{\iota}^{I})$. Figure 6-2A depicts a portion of Figure 4-3 and describes incumbent profit outcomes relevant to the incumbent's fee setting decision prior to the client's invitation decision when direct uninvited solicitation is allowed. The discounted sum of incumbent profits for periods 0,...,∞ for decision-cost combinations $\bar{A}2(\theta_1)$ and $\bar{A}4(\theta_1)$ are as described on line 11 of Tables A-16 and A-18, respectively. The incumbent's profits in periods $0,\ldots,\infty$ are zero for decision-cost combinations $\bar{A}1(\theta_2)$- $\bar{A}(\theta_5)$ as described on line 12 of Tables A-12 through A-15. Similarly, the incumbent's profits in period $0,\ldots,\infty$ are zero for decision-cost combinations $A5(\theta_2)$- $A5(\theta_5)$ as described on line 12 of Tables A-19 through A-22. The derivation of $E(\pi_{\iota}^{I})$ is easily seen to depend upon whether or not the search condition as stated in 6.12 or 6.14 is satisfied. Let $E(\pi_{\iota\sigma}^{I})$ be the incumbent's expected profit given invitation assuming that the no-search condition is not satisfied and let $E(\pi_{\iota\sigma}^{I})$ be the incumbent's expected profit given invitation assuming that the no-search condition is satisfied. Sections 6.1.1 and 6.1.2, respectively derive $E(\pi_{\iota\sigma}^{I})$ and $E(\pi_{\iota\sigma}^{I})$ and restate condition (a) in terms of the derived solutions.

6.3.1 Derivation of $E(\pi_{\iota\sigma}^{I})$ and Restatement of Condition (a)

Eliminating $\bar{A}3$ from Figure 6-2A, profit outcomes relevant to the incumbent's fee-setting decision when the no-search condition does not hold are shown on Figure 6-2B. Let $K_{\beta\bar{A}}^{I}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of the incumbent's profits for periods $0,\ldots,\infty$ for each θ_i when bidding occurs in the BAMS, i. e.,

$$K_{\beta\bar{A}}^{I} = \begin{bmatrix} S^{*} \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}. \qquad (6.21)$$

Let $K_{\bar{\beta}\bar{A}}^{I}$ be defined as the 5 X 1 vector of constant terms in the discounted sum of the incumbent's profits for periods $0,\ldots,\infty$ for each θ_i when bidding does not occur and the client searches for fee information in the BAMS, i. e.,

$$K^{I}_{\beta\bar{A}} = \begin{bmatrix} S^{*} \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}. \qquad (6.22)$$

Combining probabilities with respective profit outcomes, the incumbent's expected profit given invitation is

$$E(\pi^{I}_{\iota\sigma}) = p(\beta)\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\right] + p(\bar{\beta})\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\bar{\beta}\bar{A}}\right] \qquad (6.23)$$

Substituting $d_1\ (F^{I}_{\bar{\iota}} - C^{I})$ for $\pi^{I}_{\bar{\iota}}$ and substituting the derived value of $E(\pi^{I}_{\iota\sigma})$ in equation (6.23) into equation (6.15), condition (a) is rewritten as

$$p(\beta)\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\right] + p(\bar{\beta})\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\bar{\beta}\bar{A}}\right] < d_1(F^{I}_{\bar{\iota}} - C^{I}) \qquad (6.24)$$

Substituting for $d_1(F^{I}_{\bar{\iota}} - C^{I})$ from line 11 of Table A-23, (6.24) is written as

$$\begin{aligned} & p(\beta)\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\right] + p(\bar{\beta})\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\bar{\beta}\bar{A}}\right] < \\ & \quad p(\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\right] \\ & \quad + p(\bar{\beta})\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\right] - d_1 C^{I} - \varepsilon \end{aligned} \qquad (6.25)$$

Algebraic rearrangement of terms, described in Section B.5 of Appendix B, yields a restatement of condition (a) as follows:

$$\begin{aligned} E(\rho) \le {} & d_{10}\, S^{*} + d_{10}\ p(\bar{\beta})SC + d_{10}\ I - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(x_i) \\ & + \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)(z_i) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)(z_i) \end{aligned}$$

$$+\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j)\alpha_j - d_{10}\varepsilon(1-P_2) + d_{10}\varepsilon P_1 \tag{6.26}$$

$x_i \equiv$ the amount by which $d_{10}\,(S^*+\varepsilon)$ exceeds ρ when $\rho_i\in\theta_1$, i.e,

$x_i = d_{10}\,(S^*+\varepsilon) - \rho_i$.

Substituting λ for

$$\sum_{\rho_i\in\theta_4}\sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j)(z_i) + \sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j)(z_i)$$

$$+\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j)\alpha_j - d_{10}\varepsilon\,(1-P_2)\,,$$

(6.26) is written as

$$E(\rho) \le d_{10}S^* + d_{10}\,p(\beta)SC + d_{10}\,I + \lambda - \sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j)(x_i)$$

$$+ d_{10}\varepsilon P_1 \tag{6.27}$$

Comparing condition (a) as stated in (6.27) with condition (b) as stated in (6.20), condition (a) is seen to be stronger than condition b. Thus if condition a holds where the search condition is satisfied, the incumbent sets it's fee at F_i^I and the client does not invite.

Alternatively, the no-invitation condition (a) is written as

$$I + p(\beta)SC > d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j)(z_i)$$

$$+ d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j)(y_{i-j})$$

$$+ \varepsilon(P_3+P_4+P_5) + \varepsilon \tag{6.28}$$

The derivation of this restatement of condition (a) is described in section B.6 of Appendix B. As in the no-search condition as stated in 6.14, the no-invitation condition as stated in (6.28) is seen to depend upon the client and the incumbent's beliefs regarding θ_2 and θ_3. The lower the probability assignments to these cost difference regions, the higher the likelihood that the no-invitation condition is satisfied.

6.3.2 Derivation of $E(\pi^{I}_{\iota\bar\sigma})$ and Restatement of Condition (a)

Eliminating decision-cost combinations $\bar{A}4(\theta_1)$ and $\bar{A}5(\theta_2)$- $\bar{A}5(\theta_5)$ from Figure 6-2A, profit outcomes relevant to the incumbent's fee setting decision when the no-search condition holds are shown on Figure 6-2C. Combining probabilities with respective profit outcomes, the incumbent's expected profit given invitation is

$$E(\pi^{I}_{\iota\bar\sigma}) = p(\beta)\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\right]$$

$$p(\bar\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar\beta}\alpha + \mathbf{P}^{*T}_{\theta|\bar\beta}\mathbf{K}^{C}_{\bar\beta\bar{A}} - d_1C^{I} - \varepsilon\right] \tag{6.29}$$

Substituting for $d_1(F^{I}_{\iota} - C^{I})$ from line 11 of Table A-23 and for $E(\pi^{I}_{\iota\bar\sigma})$ from (6.29) into (6.15), condition (a) is written as

$$p(\beta)\left[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\right]$$

$$+p(\bar\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar\beta}\alpha + \mathbf{P}^{*T}_{\theta|\bar\beta}\mathbf{K}^{C}_{\bar\beta\bar{A}} - d_1C^{I} - \varepsilon\right]$$

$$< p(\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\right]$$

$$+p(\bar\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar\beta}\alpha + \mathbf{P}^{*T}_{\theta|\bar\beta}\mathbf{K}^{C}_{\bar\beta\bar{A}}\right] - d_1\ C^{I} - \varepsilon. \tag{6.30}$$

Albegraic rearrangement of terms, described in Section B.7 of Appendix B, yields

$$I > p(\beta)\left[\ d_1\sum_{\rho_i\in\theta_2}\ \sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta)z_i + d_1\sum_{\rho_i\in\theta_3}\ \sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)y_{i-j}\right.$$

$$+ \varepsilon\, (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon\Big] \qquad (6.31)$$

Comparing condition (a) as stated in (6.31) with condition (b) as stated in (6.20), condition (a) is shown to be a stronger condition than (b). This result is derived in Section B.8 of Appendix B.

6.4 Category 1 Comparisons

Comparisons are made between outcomes of decision-cost combinations of the AAMS and the BAMS assuming that the only difference between the AAMS and the BAMS is the solicitation policy. If clients invite entrants to bid, as is assumed for category 1 comparisons, the sequence of decisions of market participants is the same under the BAMS and the AAMS. As seen in Figure 3-1, entrants may bid (β) or not bid($\bar{\beta}$). If entrants bid, clients may switch (Δ) or not switch ($\bar{\Delta}$). If entrants do not bid, clients may search (σ) or not search ($\bar{\sigma}$), etc. Outcomes of the following decision-cost combinations are compared:

$A1(\theta_2)$ and $\bar{A}1(\theta_2)$
$A1(\theta_3)$ and $\bar{A}1(\theta_3)$
$A1(\theta_4)$ and $\bar{A}1(\theta_4)$
$A1(\theta_5)$ and $\bar{A}1(\theta_5)$
$A2(\theta_1)$ and $\bar{A}2(\theta_1)$
$A3$ and $\bar{A}3$
$A4(\theta_1)$ and $\bar{A}4(\theta_1)$
$A5(\theta_2)$ and $\bar{A}5(\theta_2)$
$A5(\theta_3)$ and $\bar{A}5(\theta_3)$
$A5(\theta_4)$ and $\bar{A}5(\theta_4)$
$A5(\theta_5$ and $\bar{A}5(\theta_5)$

Tables 6-1A through 6-1C summarize the cost, search and invitation conditions necessary for category 1 comparisons. For example, a comparison of outcomes for decision-cost combinations $A1(\theta_2)$ and $\bar{A}1(\theta_2)$ as shown in Table 6-1A is made assuming that the differences between production costs of entrant 1, entrant 2 and the incumbent lie in cost difference region θ_2. The boundaries of θ_2 as previously described in Table 4-5 are as follows:

$$d_{10}(S^* + \varepsilon) < \rho \leq m,$$

$$\alpha = 0 \text{ and}$$

$$d_{10}(S^* + \varepsilon) < \gamma \leq m.$$

These cost conditions and cost conditions for other category 1 comparisons are described in column 1 of Table 6-1A. All category 1 comparisons assume that invitation occurs in the BAM. Thus, the no-invitation condition does not hold. The condition regarding invitation is described in column 3. As shown in Secton 6.3, the form of the invitation condition depends upon whether or not the no-search condition as stated in 6.14 fails or holds. This condition is

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) y_{i-j}$$

$$+ \varepsilon (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon.$$

For convenience, let

$$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) y_{i-j}$$

$$+ \varepsilon (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon. \tag{6.32}$$

Substituting $\psi|\bar{\beta}$ into the no-search condition yields a restatement of (6.14) as

$$SC > \psi|\bar{\beta} \tag{6.33}$$

When the no-search condition is satisfied, invitation occurs when

$$I \leq p(\beta) \Big[d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta) y_{i-j}$$

$$+ \varepsilon (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon\Big] \tag{6.34}$$

See the no-invitation condition as stated in (6.31). For convenience, let

$$\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j}$$

$$+ \varepsilon (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon$$

Substituting $\psi|\beta$ into (6.34) yields

$$I \leq p(\beta)\psi|\beta. \tag{6.35}$$

Thus when $SC > \psi|\beta$, invitation occurs if $I \leq p(\beta)\psi|\beta$.

When the no-search condition does not hold, invitation occurs when

$$I + p(\beta)SC \leq d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$$

$$+ \varepsilon(P_3 + P_4 + P_5) + \varepsilon \tag{6.36}$$

See the no-invitation condition as stated in (6.28). For convenience let

$$\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$$

$$+ \varepsilon(P_3 + P_4 + P_5) + \varepsilon.$$

Substituting ψ into (6.36) yields

$$I + p(\beta)SC \leq \psi. \tag{6.37}$$

Thus when $SC \leq \psi|\beta$, invitation occurs when $I + p(\beta)SC \leq \psi$. When bidding occurs, as for decision combinations A1, $\overline{A}1$, A2 and $\overline{A}2$, the no-search condition may or may not hold. All category 1 comparisons as described on Table 6-1A with the exception of the comparison of A3 and $\overline{A}3$ have alternative invitation conditions.

Conditions necessary for the comparison of A3 and $\overline{A}3$ are described on Table 6-1A. There are no cost conditions necessary for this comparison. Both A3 and $\overline{A}3$ occur when the no-search condition holds, as shown in column 2. Thus, the invitation condition consistent with $SC > \psi|\beta$ is $I \leq p(\beta)\psi|\beta$ as described in column 3 of Table 6-1A.

When bidding does not occur and the client searches, as for decision combinations A4, $\overline{A}4$, A5 and $\overline{A}5$, the no-search condition does not hold. Category 1 comparisons of this nature are described on Table 6-1A.

Derived differences between outcomes of these decision-cost combinations are described on Table 6-2. Differences are easily found from outcomes of paired decision-cost combinations as described in Appendix A. For example, the differences between fees, market participant costs, market participant profits and resource expenditures for outcome $A1(\theta_2)$ and outcome $\overline{A}1(\theta_2)$ are found from comparing derived fee, market participant cost, market participant profit and resource expenditure outcomes on Tables A-1 and A-12. Assuming equality of production costs for the BAMS and the AAMS, differences are limited to invitation costs. Differences between other outcomes compared in category 1 are similarly derived and are identical to differences found for $A1(\theta_2)$ and $\overline{A}1(\theta_2)$.

6.5 Category 2 Comparisons

Category 2 comparisons assume that invitation does not occur in the BAMS and that search occurs in the AAMS when entrants do not bid, i.e., decision combination $\overline{A}6$ is compared to AAM decision-cost combinations other than A3. Category 2 includes the following comparisons:

$\bar{A}6$ and $A1(\theta_2)$
$\bar{A}6$ and $A1(\theta_3)$
$\bar{A}6$ and $A1(\theta_4)$
$\bar{A}6$ and $A1(\theta_5)$
$\bar{A}6$ and $A2(\theta_1)$
$\bar{A}6$ and $A4(\theta_1)$
$\bar{A}6$ and $A5(\theta_2)$
$\bar{A}6$ and $A5(\theta_3)$
$\bar{A}6$ and $A5(\theta_4)$
$\bar{A}6$ and $A5(\theta_5)$

Table 6-1B summarizes the cost, search and invitation conditions necessary for category 2 and 3 comparisons. The process of identifying these conditions is identical to that described for category 1 comparisons. Again, the description of the no-invitation condition depends upon the search condition. Thus, for comparisons involving decision combinations A1 and A2, alternative invitation conditions exist which depend upon whether or not the search condition holds. For comparisons involving decision combinations A4 and A5, the no-search condition does not hold and the no-invitation condition as stated in (6.31) is necessary for the comparison.

Differences and signs of differences in fee, market participant cost, market participant profit and resource expenditure outcomes for the category 2 comparisons are easily derived from Appendix A tables. Differences and the signs of differences are described on Tables 6-3 through 6-12. Differences involving fees depend upon $F_{\bar{\imath}}^{I}$.

From line 1 of Table A-23,

$$F_{\bar{\imath}}^{I} = d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}_{\theta|\beta}^{*T}\mathbf{K}_{\beta\bar{A}}^{C}\Big]$$

$$+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}\bar{A}}^{C}\Big]\Big\}.$$

Algebraic rearrangement yields

$$F_{\bar{\imath}}^{I} = C^{I} + d_{10}\, I + p(\beta)\, d_{10}\, SC + \phi - d_{10}\,\psi$$

$$\text{where } \phi = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(x_i) - d_{10} \varepsilon P_1$$

Given the restatement of F_i^I, category 2 comparisons are easily made. For example, from line 1 of Table A-1,

$$B_1^{E^*} = C^I - \rho_i + S - d_7 S^*. \tag{6.40}$$

Substituting for F_i^I from equation (6-39) and for $B_1^{E^*}$ from equation (6.40), the difference in period 0 fees is

$$F_i^I - B_1^{E^*} = \rho_i - S + d_7 S^* + d_{10} \; I + p(\beta) d_{10} SC + \phi - d_{10} \psi \tag{6.41}$$

This difference is described on row 1 of Table 6-3. Derivation of other differences are omitted as these differences are easily derived by comparing outcomes for $\bar{A}6$ on Table A-23 with outcomes for $A1(\theta_2)$ - $A1(\theta_5$ on Tables A-1 through A-4, outcomes for $A2(\theta_1)$ on Table A-5, outcomes for $A4(\theta_1)$ on Table A-7, and outcomes for $A5(\theta_2)$ - $A5(\theta_5)$ on Tables A-8 throught A-11.

Determination of the signs of differences is also straightforward. Signs of differences are either obvious or depend upon the cost, search and invitation conditions described on Tables 6-1B. For example, given the difference in period 0 fees in (6.41) above, period 0 fees are higher for the BAM than the AAM when comparing $A1(\theta_2)$ and $\bar{A}6$ if

$$\rho_i - S + d_7 S^* + d_{10} \; I + p(\beta) d_{10} SC + \phi - d_{10} \psi > 0 \tag{6.42}$$

where

$$d_7 = \frac{1}{1+r}.$$

Restatement of (6.42) in terms of $I + p(\beta)SC$ yields

$$I + p(\beta)SC > -d_1 \rho_i + d_1 S - d_2 S^* - d_1 \phi + \psi$$

For θ_2, $\rho_i > d_{10}(S^* + \varepsilon)$. Substituting $d_{10}(S^* + \varepsilon) + z_i$ for ρ_i yields

$$I + p(\bar{\beta})SC > -d_1\left[d_{10}(S^* + \varepsilon) + z_i\right] + d_1 S - d_2 S^* - d_1\phi + \psi .$$

Combining terms yields

$$I + p(\bar{\beta})SC > -SW - d_1 z_i - d_1\phi + \psi \tag{6.43}$$

As seen in Table 6-1B, the no-invitation condition is

$$I > p(\beta)\psi|\beta \text{ when} \tag{6.44}$$

$SC > \psi|\bar{\beta}$, and

$$I + p(\bar{\beta})SC > \psi \text{ when} \tag{6.45}$$

$SC \leq \psi|\bar{\beta}$. As terms on the right-hand side of (6.43) other than ψ are negative, the condition in 6.43 is satisfied when (6.45) holds. Thus when $SC \leq \psi|\bar{\beta}$ for comparison of $A1(\theta_2)$ and $\bar{A}6$, the period 0 fee is always higher under the BAM than the AAM. Determination of the consistency of condition (6.43) with (6.44) requires restatement of (6.43) in terms of $\psi|\beta$. As $\psi = p(\beta)\psi|\beta + p(\bar{\beta})\psi|\bar{\beta}$, substitution for ψ in (6.43) yields

$$I > -SW - d_1 z_i - d_1\phi - p(\bar{\beta})SC + p(\beta)\psi|\beta + p(\bar{\beta})\psi|\bar{\beta} \tag{6.46}$$

The no-invitation condition in (6.44) assumes that $SC > \psi|\bar{\beta}$. Let $SC = \psi|\bar{\beta} + SC^+$ when $SC > \psi|\bar{\beta}$. Substituting $\psi|\bar{\beta} + SC^+$ for SC in (6.46) yields

$$I > -SW - d_1 z_i - d_1\phi - p(\bar{\beta})\left[\psi|\bar{\beta} + SC^+\right] + p(\beta)\psi|\beta + p(\bar{\beta})\psi|\bar{\beta}$$

Combining terms yields

$$I > -SW - d_1 z_i - d_1\phi - p(\bar{\beta})\left[SC^+\right] + p(\beta)\psi|\beta \tag{6.47}$$

As terms on the right-hand side of (6.47) other than $p(\beta)\psi|\beta$ are negative, the condition in 6.47 is satisfied when (6.44) holds. Thus when $SC > \psi|\bar{\beta}$ for comparison of $A1(\theta_2)$ and $\bar{A}6$, the period 0 fee is always higher under the BAM than the AAM. To summarize, the period 0 fee for this comparison is shown on Table 6-3 to be unconditionally higher under the BAMS than under the AAMS. The signs of differences for other category 2 comparisons are similarly determined and shown on Tables 6-3 through 6-12. Where signs are conditional, the conditions are stated on the tables.

A discussion and summarization of category 2 results is presented in Section 6.7.

6.6 Category 3 Comparisons

Category 3 is the comparison of decision combinations $\bar{A}6$, where invitation does not occur in the BAM, with decision combination A3, where bidding and search do not occur in the AAM. Conditions required for this comparison are described on Table 6-1B. As this comparison can occur in any cost difference region, there is no cost condition. Category 3 differs significantly from both category 1 and 2 comparisons. For category 1 comparisons, the client learns the fees of entrant 1 in both the BAM and the AAM as a result of bidding or search. For category 2 comparisons, the client learns the fees of entrant 1 for the AAM only. For category 3 comparisons, neither bidding or search occurs in either the BAM or the AAM, i.e., the client remains uninformed regarding entrant 1's fees.

Derived differences between $\bar{A}6$ and A3 outcomes are described on Table 6-13. The difference in period $0,\ldots,\infty$ fees derived in Section B.9 of Appendix B is

$$F^{I}_{\bar{\iota}} - F^{I}_{\bar{\sigma}A} = -p(\beta)\left[\phi|\bar{\beta} - \phi|\beta\right] - p(\beta)d_{10}\left[\psi|\beta - \psi|\bar{\beta}\right]$$

$$- p(\beta)d_{10}SC + d_{10}I \qquad (6.48)$$

where

$$\phi|\bar{\beta} = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\bar{\beta})(x_i) - d_{10}\varepsilon P_{1|\bar{\beta}} \text{ and}$$

$$\phi|\beta = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\beta)(x_i) - d_{10}\varepsilon P_{1|\beta}.$$

As the no-search condition holds for this comparison, $SC > \psi|\bar{\beta}$. Let

$$SC = \psi|\bar{\beta} + SC^{+} \text{ where} \tag{6.49}$$

SC^{+} is the amount by which SC exceeds the lower bound for the no-search condition. Substituting for SC from (6.49) into (6.48), the difference in fees is

$$\begin{aligned} F^{I}_{\bar{\iota}} - F^{I}_{\bar{\sigma} A} = & - p\,(\beta)\left[\phi|\bar{\beta} - \phi|\beta\right] - p\,(\beta)\, d_{10}\, \psi|\beta \\ & - p\,(\beta)\, d_{10}\left[SC^{+}\right] + d_{10}\, I \end{aligned} \tag{6.50}$$

As $\phi|\bar{\beta}$ and $\phi|\beta$ depend on θ_1, it is reasonable to expect that $\phi|\bar{\beta} \geq \phi|\beta$. Where $\theta = \theta_1$, bidding is always unprofitable for entrant 1. Thus, the client assesses a higher likelihood that cost differences lie in θ_1 when bidding does not occur than when bidding occurs. As all terms in the difference in fees stated in (6.50), with the exception of d_{10} I are negative, fees may be lower in the BAM than in the AAM. Fees will always be lower in the BAM than the AAM for the comparison of $\bar{A}6$ and A3 when

$$\begin{aligned} & - p\,(\beta)\left[\phi|\bar{\beta} - \phi|\beta\right] - p\,(\beta)\, d_{10}\, \psi|\beta \\ & - p\,(\beta)\, d_{10}\left[SC^{+}\right] + d_{10}\, I < 0 \end{aligned} \tag{6.51}$$

Rearranging terms and dividing through by d_{10} yields

$$I < p\,(\beta)\left[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta + SC^{+}\right] \tag{6.52}$$

All differences between $\bar{A}6$ and A3 arise from differences in fees, as seen in Table 6-13.

6.7 Discussion and Summarization of Fee Results

The primary question addressed in this research is whether audit fees differ between the allowed and banned markets. Sections 6.4 through 6.6 describe the derivations of differences in fees between the banned and allowed markets for each possible comparison and summarize the results on Tables 6-2 through 6-13. For the purposes of discussion, these differences are usefully summarized in terms of either cost difference regions θ_1-θ_5 or in terms of decision combinations. Table 6-14A summarizes the fee difference information in Tables 6-2 through 6-13 by cost difference region for the following three categories: (i) period 0 fee differences, (ii) period 1,...,∞ fee differences , and (iii) the sum of period 0 and discounted period 1,...,∞ fee differences (total fees). Figures 6-3 through 6-5 describe fee differences for paired banned and allowed decision combinations for period 0, period 1,...,∞, and total fee differences, respectively.

Section 6.7 is organized as follows. Section 6.7.1 discusses differences in fees between the banned and allowed markets derived under the assumptions described in Chapter 3. Section 6.7.2 discusses model results when the following changes in model assumptions are made:

(1) Entrant bidding costs equal zero.

(2) Entrants know the identity of the entrant capable of providing the audit service to the client at minimum cost and whether or not

$$\rho \gtrless d_{10}(S^* + \varepsilon),$$

i.e., the identity of entrant 1 is known and entrant 1 knows whether or not switching occurs if entrant 1 bids.

Several interesting results regarding audit fees and other aspects of the market result from these model assumption alterations. The model with the original set of assumptions is hereafter referred to as the entrant uncertainty model. The model with the altered set of assumptions is referred to as the entrant certainty model.

Finally, section 6.7.3 describes several testable hypotheses suggested by these results.

6.7.1 Discussion and Summarization of Fee Results: Entrant Uncertainty Model

As previously discussed, differences between fees in the allowed market and the banned market are summarized by cost difference region and by the set of possible pairs of decision combinations, where a pair consists of a decision combination in the allowed market and a decision combination in the banned market. Table 6-14A describes the direction of period 0, period 1 and discounted period 1,...,∞ fee differences for each possible decision combination by cost difference region. Differences of ">", "<" or "=" indicate that fees in the banned market are higher, lower or equal to fees in the allowed market. Figure 6-3A summarizes these differences for each possible pair of banned and allowed decision combinations. It is important to note that fee differences represented as "$\gtreqless$" do not indicate indeterminancy. Instead, "$\gtreqless$" indicates the existence of conditions under which fees are ">", "<" or "=". These conditions were previously stated on Tables 6-2 through 6-13. For convenience, they are also described as footnotes on Table 14-A. Three types of solutions are found for period 0, period 1,...,∞ and "total" fee comparisons where the term "total" refers to the sum of period 0 and discounted period 1,...,∞ fees. These are as follows:

(1) Fees are the same in the banned and allowed, i.e., the policy of banning direct uninvited solicitation has no effect on fees. This result is indicated by the equal sign (=).

(2) Fees are higher in the banned market as compared to the allowed market. This result is indicated by the greater than sign (>).

(3) Fees may or may not differ between the policies of banning and allowing direct uninvited solicitation, depending upon the existence of certain conditions as described on Table 6-14.

6.7.1.1 Direct uninvited solicitation has no effect on fees

Fees in the banned and allowed markets are shown to be equal (=) when clients invite bidding in the banned market. As shown in Figures 6-3, 6-4 and 6-5, once invitation occurs, there are no differences in market participants' decisions. That is, the bidding decision, the search decision, and the switching decision are the same in both the banned and the allowed markets. This result in also shown on Table 14-A for the comparisons A1 to $\bar{A}1$, A2 to $\bar{A}2$, A3 to $\bar{A}3$, A4 to $\bar{A}4$ and A5 to $\bar{A}5$.

6.7.1.2 Fees differ between the banned and allowed markets

The policy of banning direct uninvited solicitation creates differences in fees only when the incumbent's profit-maximizing decision is to set fees at a no-invitation level when direct uninvited solicitation is banned. The question arises then as to the likelihood that invitation will occur in the banned audit market. The condition under which invitation occurs was previously shown to differ depending upon the search condition. If the search condition holds, i.e., if

$$SC \leq \psi|\bar{\beta},$$

invitation occurs if

$$I + p(\bar{\beta})SC < \psi.$$

If the search condition does not hold, i.e.,

$$SC > \psi|\bar{\beta},$$

invitation occurs if

$$I < p(\beta)\ \psi|\beta.$$

Gaining insight as to the likelihood of invitation requires an understanding of ψ, $\psi|\beta$, and $\psi|\beta$. For convenience, these previously defined terms are described below.

$$\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + \varepsilon(P_3 + P_4 + P_5) + \varepsilon.$$

$$\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j} + \varepsilon\ (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon.$$

$$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\ (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon.$$

where $z_i \equiv$ the amount by which ρ exceeds $d_{10}\ (S^* + \varepsilon)$, i.e,

$z_i = \rho_i - d_{10}\ (S^* + \varepsilon)$.

Also, $y_{i\text{-}j} \equiv$ the amount by which γ exceeds $d_{10}\ (S^* + \varepsilon)$, i.e,

$y_{i\text{-}j} = \gamma_{i\text{-}j} - d_{10}\ (S^* + \varepsilon)$.

Two observations are useful in gaining intuition regarding the likelihood of invitation. First of all, ψ, $\psi|\beta$ and $\psi|\bar{\beta}$ primarily depend on the client's assessments of cost regions θ_2 and θ_3. θ_2 is defined as the region in which $C_1^E + d_{10}(S^* + \varepsilon) = C_2^E + d_{10}(S^* + \varepsilon) < C^I$. θ_3 is defined as the region in which $C_1^E < C_2^E$ and $C_2^E + d_{10}(S^* + \varepsilon) < C^I$. Thus, in each case, both entrant 1 and entrant 2 are more efficient than the incumbent by a margin of at least $d_{10}(S^* + \varepsilon)$. Second, $\psi|\bar{\beta}$ should be low. Clients would expect entrants to bid if cost differences lie in region θ_2 or θ_3. When bidding does not occur, clients are likely to assess low probabilities to differences in these regions. Thus, if search costs are non-trivial, it seems likely that SC will exceed $\psi|\bar{\beta}$. If $SC > \psi|\bar{\beta}$, invitation does not occur if $I > p(\beta)\psi|\beta$. If, for example, the client believes that the incumbent is as efficient or more efficient than entrant 1, $p(\beta)$ will approach zero and it appears likely that invitation would not occur, resulting in differences between fees in the banned and allowed markets. Alternatively, if the client believes that entrant 1's production cost is less than the incumbent's by a margin of at least $d_{10}(S^* + \varepsilon)$, $p(\beta)$ will approach 1 and invitation appears likely, resulting in no difference between fees in the banned and allowed markets.

When the no-invitation condition is satisfied ($\bar{A}6$), two categories of results occur. First, period 0, period 1,...,∞ and total fees may be strictly higher in the banned market as compared to the allowed market. Second, period 0, period 1,...,∞ and total fee differences may be higher or lower in the banned market as compared to the allowed market, depending upon the existence of certain conditions as described on Table 6-14A.

Period 0 fees and total fees are strictly higher in the banned market as compared to the allowed market when switching occurs in the allowed market (A1 and A5) and invitation does not occur in the banned market ($\bar{A}6$). Switching occurs in the allowed market if entrants bid and entrant 1's production cost is lower than the incumbent's by a margin of at least $d_{10}(S^* + \varepsilon)$, i.e., $\rho > d_{10}(S^* + \varepsilon)$. If entrants do not bid, switching occurs if the client searches and $\rho > d_{10}(S^* + \varepsilon)$. Search occurs where $SC > \psi|\beta$. Note that $\rho > d_{10}(S^* + \varepsilon)$ for cost difference regions θ_2-θ_5. Decision combinations A1 and A5 never occur in cost difference region θ_1. This is indicated on Table 6-14A with an asterisk (*). See Figure 6-3A and 6-5A for a summary of this result.

Period 1,...,∞ fees are also strictly higher in the banned market as compared to the allowed market when invitation does not occur in the banned market ($\bar{A}6$) and switching occurs in the allowed market (A1 and A5) for all cost difference regions where $\rho > d_{10}(S^* + \varepsilon)$ with the exception of θ_5. θ_5 occurs where $C_1^E + d_{10}S^* < C^I < C_2^E$. This region differs from θ_2, θ_3 and θ_4 because entrant 2 is the most powerful competitor of entrant 1 in periods 1,...,∞ for θ_2 - θ_4 and the "deposed" incumbent is the most powerful competitor of entrant 1 in periods 1,...,∞ for θ_5. Footnotes (i) and (v) on Table 6-14A describe the conditions under which the sign of the fee difference is ≥ and < for A1 compared to $\bar{A}6$ and A5 compared to $\bar{A}6$, respectively. For convenience, these are described below.

(i) When bidding and switching occur (A1), there is no information regarding the search condition. The fee difference condition is dependent upon the relationship between SC and $\psi|\beta$. When $SC \leq \psi|\beta$, the sign of the difference is ≥ for $\phi \geq d_{10} S^*$ and the sign of the difference is < for $\phi < d_{10} S^*$. When $SC > \psi|\beta$, the sign of the difference is ≥ for $\phi \geq d_{10} S^* - p(\beta) d_{10} [SC^+]$ and the sign of the difference is < for $\phi < d_{10} S^* - p(\beta) d_{10} [SC^+]$

where $\phi = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(x_i) - d_{10} \varepsilon P_1$, i.e., it is a measure of the client's belief regarding the likelihood that $\rho < d_{10} (S^* + \varepsilon)$. Also,

$x_i \equiv$ the amount by which $d_{10}\,(S^*+\varepsilon)$ exceeds ρ when $\rho_i \in \theta_1$, i.e,

$x_i = d_{10}\,(S^*+\varepsilon) - \rho_i$.

(v) When bidding does not occur, search occurs and switching occurs (A5), SC is known to be less than or equal to $\psi|\beta$ and the sign of the fee difference is $\geq$ for $\phi \geq d_{10}\,S^*$ and the sign of the difference is < for $\phi < d_{10}\,S^*$.

When a client believes that entrant 1's costs are low enough relative to the incumbent's for switching to occur, i.e., for $\rho > d_{10}\,(S^*+\varepsilon)$, ϕ will be low and the no-invitation fee is forced downward, yielding conditions where period 1,...,∞ fees are lower in the banned market than the allowed market. As discussed earlier, even though fees may be lower in the banned market for periods 1,...,∞ for cost difference region θ_5, total fees in the banned market exceed total fees in the allowed market for this region. Thus, the higher period 0 fees are sufficient to offset the lower discounted sum of period 1,...,∞ fees, and total fees are higher in the banned market as compared to the allowed market for cost difference region θ_5 for decision combinations A1 and A5.

When bidding or search occurs in the allowed market and switching does not occur (A2 and A4) and invitation does not occur in the banned market ($\bar{A}6$), period 0, period 1,...,∞ and total fees in the banned market may be greater than, less than or equal to fees in the allowed market. Footnotes (ii) and (iv) on Table 6-14A describe the conditions under which the sign of the period 0, period 1,...,∞ and total fee differences are $\geq$ and < for A2 compared to $\bar{A}6$ and A4 compared to $\bar{A}6$, respectively. For convenience, these are described below.

(i) When bidding occurs and the client does not switch (A2), there is no information regarding the search condition. The fee difference condition for the period 0, period 1,...∞ and total fee differences is dependent upon the relationship between SC and $\psi|\beta$. When $SC \leq \psi|\beta$, the sign of the difference is $\geq$ for $x_i \leq \phi + d_{10}\varepsilon$ and the sign of the difference is < for $x_i > \phi + d_{10}\varepsilon$. When $SC > \psi|\beta$, the sign of the difference is $\geq$ for $x_i \leq \phi + d_{10}\varepsilon + p(\beta)\,d_{10}\,[SC^+]$ and the sign of the difference is < for $x_i > \phi + d_{10}\varepsilon + p(\beta)\,d_{10}\,[SC^+]$.

(v) When bidding does not occur, search occurs and switching does not occur (A4), SC is known to be less than or equal to $\psi|\bar{\beta}$ and the signs of the fee differences for period 0, period 1,...,∞ and total fees are ≥ for $x_i \le \phi + d_{10}\varepsilon$ and the signs of the difference are < for $x_i > \phi + d_{10}\varepsilon$.

The sign of this difference depends entirely on the client's assessment of cost differences relative to actual cost differences. A2 and A4 occur only for cost difference region θ_1, i.e., where $\rho < d_{10}(S^* + \varepsilon)$. The no-invitation fee is positively related to ϕ. ϕ is relatively high when the client correctly believes that $\rho < d_{10}(S^* + \varepsilon)$ as compared to when the client incorrectly believes $\rho > d_{10}(S^* + \varepsilon)$. Thus, the possibility that fees are lower in the banned market as compared to the allowed market arises from the client's erroneous belief that entrant costs are lower than they actually are.

When bidding and search do not occur in the allowed market (A3) and invitation does not occur in the banned market ($\bar{A}6$), period 0, period 1,...,∞ and total fees in the banned market may be greater than, less than or equal to fees in the allowed market. Footnote (iii) on Table 6-14A describes the conditions under which the sign of the period 0, period 1,...,∞ and total fee differences are ≥ and < for A3 compared to $\bar{A}6$. For convenience, these are described below.

(iii) The sign of the difference is ≥ for $I > p(\beta)[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta - \psi|\bar{\beta} + SC]$.
The sign of the difference is < for $I < p(\beta)[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta - \psi|\bar{\beta} + SC]$.

$$\phi|\bar{\beta} = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\bar{\beta})(x_i) - d_{10}\varepsilon P_{1|\bar{\beta}},$$

$$\phi|\beta = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\beta)(x_i) - d_{10}\varepsilon P_{1|\beta},$$

$$\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j} + \varepsilon\,(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon$$

and

$$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\,(P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon.$$

The signs of terms on the right-hand side of this condition will be as follows:

Term or terms	Sign	Explanation
$\phi\|\bar{\beta} - \phi\|\beta$	> 0	$\phi\|\bar{\beta}$ is a measure of the client's belief regarding the likelihood that cost differences lie in θ_1 when bidding does not occur. $\phi\|\beta$ is a measure of the client's belief regarding the likelihood that cost differences lie in θ_1 when bidding does occur. Switching does not occur in cost difference region θ_1. Given perfect knowledge of cost differences, entrant 1 bids only if the client will switch, i.e., if the cost difference is not in θ_1. Thus, the client assess a higher likelihood that cost differences lie in θ_1 when bidding does not occur as compared to when bidding does occur.
$\psi\|\beta$	> 0	The sum of the z_i and y_{j-j}, both of which are greater than 0, weighted by probability assessments must exceed 0.
$-\psi\|\bar{\beta} + SC$	> 0	A comparison of A3 with $\bar{A}6$ occurs only where the search condition does not hold, i.e., where $SC > \psi\|\bar{\beta}$.

What is the likelihood that fees will be higher under the banned market? First of all, this comparison occurs when the no-invitation condition holds, i.e., where

$$I > p(\beta)\ \psi|\beta\ .$$

If the client assess the probability of bidding [$p(\beta)$] as zero, fees will definitely be higher in the banned market as compared to the allowed market. If, $p(\beta)$ exceeds 0, then the size of search costs is the factor most likely to be of interest in assessing whether or not fees are higher in the banned market as compared to the allowed market. For example, assume that the client believes that the $p(\beta)$ is .5. Then fees are lower in the banned market as compared to the allowed market if invitation costs are less than one half the size of search costs. Typically, invitation costs will be quite small. For example, invitation may consist of a letter. This does not, however, imply that the consequences of inviting entrants to bid are trivial.

6.7.2 Discussion and Summarization of Fee Results: Entrant Certainty Model

This section discusses results when the following changes in model assumptions are made:

(1) Entrant bidding costs are assumed to equal zero.

(2) Entrants know the identity of the entrant capable of providing the audit service to the client at minimum cost and whether or not

$\rho \gtrless d_{10}(S^{*}+\varepsilon)$,

i.e., the identity of entrant 1 is known and entrant 1 knows whether or not switching will occur if entrant 1 bids.

Several interesting results regarding audit fees and other aspects of the market result from these model assumption alterations. The most significant result is that search never occurs in the audit market when these assumptions hold. Search occurs when $SC \leq \psi|\beta$. When entrant 1has knowledge of whether or not $\rho \gtrless d_{10}(S^{*}+\varepsilon)$, entrant 1 will always bid if $\rho > d_{10}(S^{*}+\varepsilon)$ and will never bid if $\rho < d_{10}(S^{*}+\varepsilon)$. Thus, if bidding does not occur in the banned market, $\psi|\beta$, a measure of the client's belief that $\rho > d_{10}(S^{*}+\varepsilon)$, will equal zero. As search costs are assumed to be non-trivial, search costs will always exceed $\psi|\beta$ and search will never occur. This result indicates that the client's belief in entrant uncertainty is a necessary market condition for search to occur. Figures 6-3B, 6-4B and 6-5B as well as Table 6-14B describe fee results for the entrant certainty model. The most significant difference between the entrant certainty and entrant uncertainty models is the number of possible comparisons. For example, Figure 6-3A describes the 10 possible decision combination comparisons for the entrant uncertainty model. This number is reduced to 4 possible decision combination comparisons for the entrant certainty model. Decision combinations A4, A5, $\bar{A}4$ and $\bar{A}5$ are eliminated as these decision combinations include the decision to search. Decision combination A2 is also eliminated as this combination assumes that bidding occurs when $\rho < d_{10}(S^{*} + \varepsilon)$, i.e., when switching will not occur. A second notable difference is the conditions, as shown on Table 6-14B, under which fees in the banned market are greater or less than fees in the allowed market when bidding does not occur in the allowed market (A3) and invitation does not occur in the banned market ($\bar{A}6$). Fees are lower in the banned market where

$$I < p\,(\beta)[d_1\phi|\bar{\beta} + \psi|\beta + SC].$$

From the no-invitation condition, $I > p(\beta)\psi|\beta$. The variables of interest again include search costs and $d_1\phi|\bar{\beta}$. To gain some insight into this condition, assume that the client assesses a probability of 1 that $\rho = 0$ when entrants do not bid. The condition $I < p(\beta)[d_1\phi|\bar{\beta} + \psi|\beta + SC]$ is rewritten as

$$I < p(\beta)(S + SW + SC - \varepsilon) + p(\beta)\psi|\beta.$$

If we further assume that $p(\beta)$ is greater than .5, it seems probable that fees would be lower in the banned market as compared to the allowed market. If on the other hand $p(\beta) = 0$, fees would definitely be higher in the banned market as compared to the allowed market, regardless of the client's assessment of $\phi|\bar{\beta}$.

6.7.3 Testable Hypotheses Regarding Fee Differences

Several research questions capable of empircal testing are suggested by the fee results described in the model of entrant uncertainty and entrant certainty. As noted earlier, three categories of fee difference results occur, i.e., (i) fees are the same in the banned and allowed markets, (ii) fees are strictly higher in the banned market as compared to the allowed market and (iii) fees in the banned market are higher, lower or equal to fees in the allowed market.

Empirically testable hypotheses are as follows:

1. When switching occurs in both the banned and allowed markets, differences in period 0 fees , fees in periods subsequent to period 0 and the sum of period 0 fees and discounted fees in periods subsequent to period 0 do not depend upon the policy of banning or allowing direct uninvited solicitation.

2. a. When switching occurs in the allowed market and invitation does not occur in the banned market, fees in the banned market are higher than fees in the allowed market in the period of switching.

   b. When switching occurs in the allowed market and invitation does not occur in the banned market, fees differ between the banned and allowed markets in periods subsequent to switching.

   c. When switching occurs in the allowed market and invitation does not occur in the banned market, total fees (the sum of the period 0 fee and discounted period $1,\ldots,\infty$ fees) are higher in the banned market than in the allowed market.

3. When switching does not occur in the allowed market and invitation does not occur in the banned market, fees differ between the banned and allowed markets in every period.

A complete description of research design is beyond the scope of this paper. Each of the above questions could, however, be tested using regression models with audit fees as a dependent variable, variables hypothesized to relate to audit fees as independent variables with a dummy variable indicating whether or not the audit service is performed in a banned or allowed market. Several studies, e.g., Simunic (1980) and Rubin (1988) have utilized regressions of prices against variables of interest. Tests of hypothesis 1 would require knowledge of whether or not switching occurs, knowledge of audit fees charged in the year of switching and knowledge of variables for the year of switching. Tests of hypothesis 2a would require knowledge of whether or not switching occurs, knowledge of whether or not invitation occurs in the banned audit market, knowledge of audit fees charged in the period of switching and knowledge of variables for the year of switching. Tests of hypothesis 2b would require knowledge of whether or not switching occurs, knowledge of whether or not invitation occurs in the banned audit market, knowledge of audit fees charged in several periods subsequent to switching and knowledge of variables for years subsequent to switching. Although model results indicate that fees are strictly higher in the banned market as compared to the allowed market in cost difference regions θ_2-θ_5, the test for hypothesis 2b would be non-directional because of the possibility of lower fees for cost difference region θ_5. Tests of hypothesis 2c would require knowledge of whether or not switching occurs, knowledge of whether or not invitation occurs in the banned audit market, knowledge of audit fees charged in the period of switching and in several subsequent periods and knowledge of variables for the year of switching and for several subsequent periods. Tests of hypothesis 3 would require knowledge of whether or not switching occurs, knowledge of whether or not invitation occurs in the banned audit market, knowledge of audit fees charged in several periods and knowledge of variables for several periods. The test for hypothesis 3 would be non-directional.

The knowledge of whether or not a client switches is publicly available information, and a summary of this information is compiled in Who Audits America. The knowledge of whether or not invitation occurs in the banned audit market and knowledge of audit fees would require questionnaires mailed to audit clients. Knowledge of the control variables would require questionnaires or relevant publicly available data.

6.8 Discussion and Summarization of Resource Expenditure Results

The results of comparison of resource expenditures between the banned and allowed markets are described on Tables 6-15A and 6-15B for the entrant uncertainty model and the entrant certainty model, respectively. Total resources expended include production costs and "other costs". Other costs include bidding costs expended by audit firms and switching costs (SW), search costs (SC) and invitation costs (I) incurred by the client. Figure 6-6A summarizes results for the 10 decision combination comparisons for the entrant uncertainty model. Footnotes (i) - (x) describe necessary conditions for each comparison to occur. Differences for the entrant uncertainty model can be classified into four categories as discussed below. First, resource expenditures do not differ between the banned and the allowed market for the comparison of decision combination A3 and $\bar{A}6$, as shown on Figure 6-6A. No switching, invitation costs or search costs are incurred in either the banned or the allowed markets. As switching does not occur in either market, production costs are the same in both.

Second, as seen on Figure 6-6A, resource expenditures are strictly higher in the banned market as compared to the allowed market where invitation occurs in the banned market. This difference is equal to the invitation cost the client incurs in the banned market.

Third, as seen on Figure 6-6A, resource expenditures are strictly lower in the banned market as compared to the allowed market where invitation does not occur in the banned market and either decision combination A2 or A4 occurs in the allowed market. As switching occurs in neither market, the difference results from bidding costs or search costs incurred in the allowed market which are not incurred in the banned market.

Fourth, total resource expenditures in the banned market are greater than, less than or equal to resource expenditures in the allowed market where invitation does not occur in the banned market and either decision combination A1 or A5 occurs in the allowed market, depending on the existence of conditions described on Table 6-15A. As switching occurs in the allowed market, total resource expenditures are greater in the banned market as compared to the allowed market if the reduction in production cost from C^I to C_1^E is sufficient to offset the transaction costs incurred, i.e., search costs or bidding costs.

Figure 6-6B and Table 6-15B summarize results for the 4 decision combination comparisons for the entrant certainty model. Footnotes (i) - (iv) on Figure 6-6B describe necessary conditions for each comparison to occur. As seen on both Figure 6-6B and Table 6-15B, total resource expenditures in the banned market are either greater than or equal to resource expenditures in the allowed market. Thus, where resource expenditures were found to be lower in the banned market as compared to the allowed market in the entrant uncertainty model, results are attributed to the existence of entrants' errors in bidding or the client's error in searching. When entrant certainty is assumed, the "<" results disappear.

6.9 Discussion and Summarization of Audit Firm Profitability and Client Cost Results

The results of audit firm profitability and client cost comparisons between the banned and allowed markets are described on Tables 6-16A and 6-16B for the entrant uncertainty model and the entrant certainty model, respectively. Figure 6-7A, 6-8A and 6-9A summarize incumbent profit, entrant profit and client cost results, respectively for the 10 decision combination comparisons of the entrant uncertainty model. Footnotes (i) - (x) of each of these figures describe necessary conditions for each comparison to occur. Differences in incumbent profits for the entrant uncertainty model can be classified into three categories as discussed below. First, incumbent profits do not differ between the banned and the allowed when invitation occurs in the banned market, as shown on Figure 6-7A. Second, as seen on Figure 6-7A, incumbent profits are strictly higher in the banned market as compared to the allowed market when invitation occurs in the banned market and either decision combination A1 or A5 occur in the allowed market. This is not surprising as both A1 and A5 involve client switching. Third, as seen on Figure 6-7A, incumbent profits in the banned market are greater than, less than or equal to incumbent profits in the allowed market when invitation does not occur in the banned market and either decision combination A2, A3 or A4 occurs in the allowed market, depending on the existence of conditions described on Table 6-16A. For each of these comparisons, the incumbent is retained in both the banned and the allowed markets. This result is primarily dependent upon the relationship of fees between the banned and allowed markets.

Figure 6-7B and Table 6-16B summarize incumbent profit difference results for the 4 decision combination comparisons of the entrant certainty model. Footnotes (i) - (iv) on Figure 6-7B describe necessary conditions for each comparison to occur. As seen on both Figure 6-7B and Table 6-16B, the number of comparisons is decreased but the results are the same forboth the entrant uncertainty and the entrant certainty model for the set of remaining comparisons.

Differences in entrant 1's profits for the entrant uncertainty model are described on Figure 6-8A and Table 6-16A and can be classified into two categories as discussed below. First, entrant 1's profits do not differ between the banned and the allowed when invitation occurs in the banned market, as shown on Figure 6-8A. Also, entrant profits are obviously the same when invitation does not occur in the banned market and switching does not occur in either market, as for the comparison of $\bar{A}6$ with either A2, A3 or A4. Second, as seen on Figure 6-8A, entrant profits in the banned market are greater than, less than or equal to entrant profits in the allowed market when invitation does not occur in the banned market and either decision combination A1 or A5 occurs in the allowed market, depending on the existence of conditions described on Table 6-16A. Examination of the conditions reveals that unless bidding costs are quite high, the usual result is that profits are lower in the banned market as compared to the allowed market for these two comparisons.

Figure 6-8B and Table 6-16B summarize entrant profit difference results for the 4 decision combination comparisons of the entrant certainty model. Footnotes (i) - (iv) on Figure 6-8B describe necessary conditions for each comparison to occur. As seen on both Figure 6-8B and Table 6-16B, the number of comparisons is decreased but the results are the same for both the entrant uncertainty and the entrant certainty model for the set of 4 remaining comparisons.

Differences in client costs for the entrant uncertainty model are described on Figure 6-9A and Table 6-16A. Client costs include total fees, switching costs, invitation costs and search costs. Results can be classified into two categories as discussed below. First, client cots are strictly greater in the banned market as compared to the allowed when invitation occurs in the banned market, as shown on Figure 6-9A. Also, client costs are strictly greater in the banned market as compared to the allowed market when invitation does not occur in the banned market and decision combination A1 occurs in the allowed market. Second, as seen on Figure 6-9A, client costs in the banned market are greater than, less than or equal to entrant profits in the allowed market when invitation does not occur in the banned market and decision combination A2, A3, A4 or A5 occurs in the allowed market. The sign of the difference depends on the existence of conditions described on Table 6-16A. The sign of the difference is explained primarily by the sign of the difference in total fees between the banned and allowed market.

Figure 6-9B and Table 6-16B summarize client cost difference results for the 4 decision combination comparisons of the entrant certainty model. Footnotes (i) - (iv) on Figure 6-9B describe necessary conditions for each comparison to occur. As seen on both Figure 6-8B and Table 6-16B, the number of comparisons is decreased but the results are the same for both the entrant uncertainty and the entrant certainty model for the set of 4 remaining comparisons.

6.10 A Comparison of the Frequency of Switching in the Banned and Allowed Markets

The results of this research indicate the possibility of differences in the frequency of switching in the banned and the allowed markets. When bidding occurs, the client's decision to switch depends only upon the difference in production costs between the incumbent and the most efficient entrant (entrant 1). Where entrant 1's production costs are lower than the incumbents by at least $d_{10} (S^* + \varepsilon)$, clients switch. The frequency with which this occurs is unknown. However, switching is observed in the audit market, indicating that this cost difference condition is satisfied or that there are other factors related to switching. Undoubtedly, conditions other than efficiency differences do exist and can account for some portion of the observed switching. A number of studies have examined reasons for auditor switching. Switching occurs for a variety of reasons, e.g., conflicts between the audit firm and client regarding principles or the audit report, mergers, and audit fees. Several studies point to the replacement of inefficient auditors as a reason for switching [Arnett and Danos (1979) and Williams (1985)]. The stated reason for switching audit firms is sometimes prices. Bedingfield and Loeb (1974) and Eichenseher and Shields (1983) find audit fees to be a significant variable related to auditor switching. Power (1984) stated that the most frequently stated reason for switching as reported in the Public Accounting Report is for cost savings.If the existence of the switching condition is as likely to exist in the banned market as in the allowed market, the following testable hypothesis results:

> Switching occurs more frequently in the allowed markets than in the banned markets.

6.11 A Comparison of Advertising in the Banned and Allowed Markets

When firms are allowed to self-select and solicit clients in the allowed market, the question arises as to audit firms' preferences for advertising to a general audience as compared to directly soliciting a subset of potential clients. Assume for the purposes of the following discussion that advertising includes all forms of solicitation other than direct uninvited solicitation. Given the differentiated nature of the audit service across clients, the ability of an audit firm to communicate fee information through a general advertising effort is doubtful. Assume that it is less costly for audit firms to target a specific group of clients than to engage in a broad-base advertising effort. Then, given a choice, audit firms will directly solicit a potential client served by another as opposed to indirectly soliciting that client through advertising. Under this assumption, there is no role for fee advertising in the allowed audit market. An audit firm engages in direct uninvited solicitation if the firm believes that it's cost of production for the client are less than the incumbent's by a margin of at least $d_{10} (S^* + \varepsilon)$.

If audit firms prefer advertising to direct uninvited solicitation in some or all cases, advertising has several potential effects in the audit market. First, advertising can influence the client's fee information search decision. When entrant audit firms do not self-select and engage in direct uninvited solicitation, the client decides whether or not to search for fee information. The client searches if

$SC' > \psi|\beta$ where

$$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j+\varepsilon} \, (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon.$$

The communication of information regarding a firm's audit technology through indirect means, e.g., publications, advertising in journals, etc., can provide the client with information regarding differences in the production costs of entrant 1, entrant 2 and the incumbent. The effects of advertising upon the search condition are two-fold. First, fee information search costs are lower when audit firms engage in advertising which is useful for fee determination, thus lowering the left-hand side of this equation. Second, advertising may change the client's beliefs regarding cost differences. This will increase or decrease the right-hand side of the condition, depending upon what the client learns.

Additionally, advertising in the allowed market may alter the no-search fee, i.e.,

$$F^{I}_{\bar{\sigma}A} = C^{I} + d_{10}SC + \phi|\bar{\beta} - d_{10}\,\psi|\bar{\beta}$$

where

$$\phi|\bar{\beta} = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\bar{\beta})(x_i) - d_{10}\,\varepsilon P_{1|\bar{\beta}}$$

and

$$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j+\varepsilon} \, (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon.$$

If advertising is a useful mechanism for informing clients of cost differences, search costs will decrease and $\psi|\bar{\beta}$ will tend towards zero. The sign of $\phi|\bar{\beta}$ depends upon what the client learns. Thus, changes in the client's beliefs regarding the relative efficiency of the incumbent and entrant audit firms can affect the audit price, i.e., a direct relationship between advertising expenditures and audit fees exists when neither bidding or search occur in the allowed market. To summarize, the following relationships are hypothesized in the allowed audit market.

1. When switching or search occur in the allowed audit market, there is no relationship between the level of advertising expenditures and audit fees.
2. When neither switching or search occur in the audit market, audit fees are related to advertising expenditures.

What is the role of advertising in the banned market? To simplify the discussion, the discussion is limited to the entrant certainty model. When direct uninvited solicitation is banned, the client invites entrants to bid if

$$I < p(\beta)\ \psi|\beta \text{ where}$$

$$\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j} + \varepsilon\ (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon.$$

As entrants cannot solicit clients without invitation, their only means of informing clients of their efficiency relative to the incumbent's is through advertising. Entrants with production costs lower than the incumbent's by a margin of at least $d_{10}(S^* + \varepsilon)$ have incentives to engage in advertising if advertising efforts are sufficient to change the client's beliefs such that the invitation condition is satisfied, i.e., $p(\beta)\ \psi|\beta > I$. Thus, the first potential effect of indirect solicitation in the banned audit market is to influence the client's invitation decision.

Second, there will be a relationship between audit fees and advertising expenditures when invitation does not occur. The no-invitation fee, F_{ι}^{I}, depends upon client's belief, i.e.,

$$F_{\iota}^{I} = C^{I} + d_{10} I + p(\beta)\ d_{10} SC + \phi - d_{10} \psi \quad \text{where}$$

$$\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + \varepsilon(P_3 + P_4 + P_5) + \varepsilon \text{ and}$$

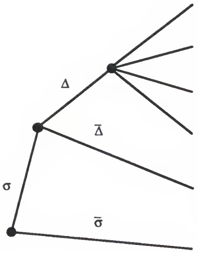
$$\phi = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(x_i) - d_{10} \varepsilon P_1.$$

To summarize, the following hypothesis is suggested:

3. When invitation does not occur in the banned audit market, audit fees are related to advertising expenditures.

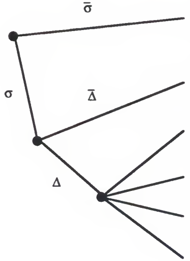
When invitation occurs, the relationship between advertising expenditures and audit fees is the same as for the allowed market, i.e., a relationship is hypothesized when neither switching or search occur and no relationship is hypothesized to exist when switching and/or search occur.

Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision
Prior to Search: AAMS



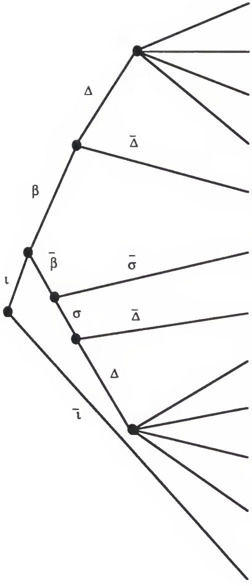
Outcome	Discounted Sum of Incumbent Profits in Periods 0,...,∞
A5(θ_2)	- 0 -
A5(θ_3)	- 0 -
A5(θ_4)	- 0 -
A5(θ_5)	- 0 -
A4(θ_1)	$- d_1\rho_i + S^*$
A3	$\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\hat{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}A}$ $- \varepsilon - d_1 C^{I}$

Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision
Prior to Search: BAMS



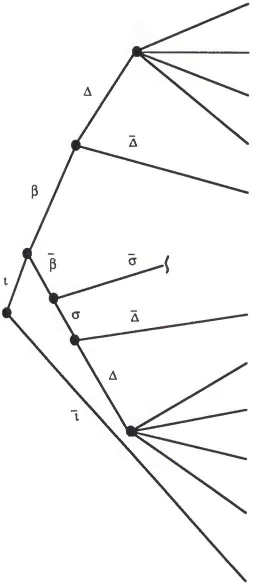
Outcome	Discounted Sum of Incumbent Profits in Periods 0,...,∞
$\bar{A}$3	$\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\hat{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$ $- \varepsilon - d_1 C^{I}$
$\bar{A}$4(θ_1)	$- d_1\rho_i + S^*$
$\bar{A}$5(θ_5)	- 0 -
$\bar{A}$5(θ_4)	- 0 -
$\bar{A}$5(θ_3)	- 0 -
$\bar{A}$5(θ_2)	- 0 -

Figure 6-1
Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision
Prior to Search



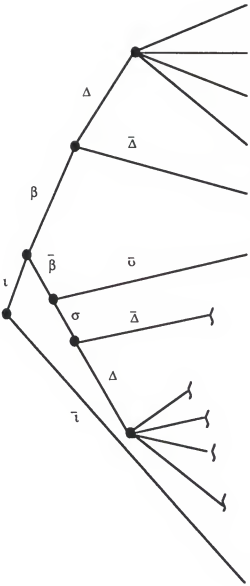
Outcome	Discounted Sum of Incumbent Profits in Periods 0,...,∞
$\bar{A}1(\theta_2)$	- 0 -
$\bar{A}1(\theta_3)$	- 0 -
$\bar{A}1(\theta_4)$	- 0 -
$\bar{A}1(\theta_5)$	- 0 -
$\bar{A}2(\theta_1)$	$- d_1\rho_i + S^*$
$\bar{A}3$	$\mathbf{A}^{CT}\mathbf{P}_{\theta\|\bar\beta}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\|\bar\beta}\,\alpha + \mathbf{P}^{*T}_{\theta\|\bar\beta}\mathbf{K}^{C}_{\bar\beta\bar A}$ $- \varepsilon - d_1C^I$
$\bar{A}4(\theta_1)$	$- d_1\rho_i + S^*$
$\bar{A}5(\theta_2)$	- 0 -
$\bar{A}5(\theta_3)$	- 0 -
$\bar{A}5(\theta_4)$	- 0 -
$\bar{A}5(\theta_5)$	- 0 -
$\bar{A}6$	$p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\|\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\|\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\|\beta}\mathbf{K}^{C}_{\beta\bar A}]$ $+\ p(\bar\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\|\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\|\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\|\bar\beta}\mathbf{K}^{C}_{\bar\beta\bar A}]$ $- \varepsilon - d_1C^I$

Figure6-2A
Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision Prior to Invitation: BAM



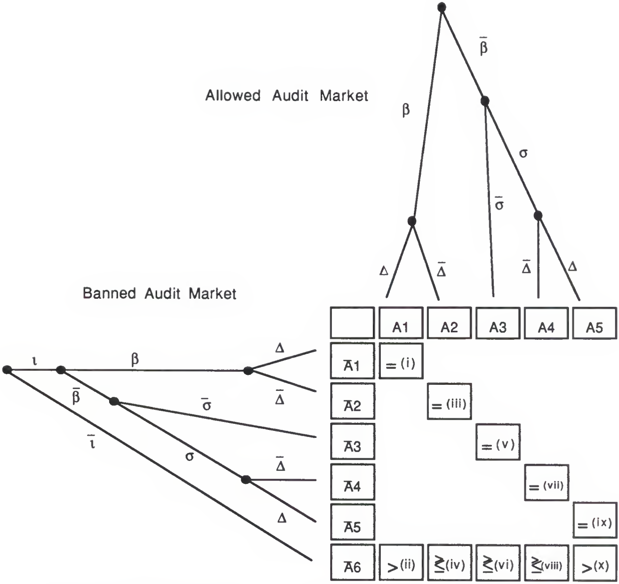
Outcome	Discounted Sum of Incumbent Profits in Periods 0,...,∞
$\bar{A}1(\theta_2)$	- 0 -
$\bar{A}1(\theta_3)$	- 0 -
$\bar{A}1(\theta_4)$	- 0 -
$\bar{A}1(\theta_5)$	- 0 -
$\bar{A}2(\theta_1)$	$-d_1\rho_I+S^*$
$\bar{A}4(\theta_1)$	$-d_1\rho_I+S^*$
$\bar{A}5(\theta_2)$	- 0 -
$\bar{A}5(\theta_3)$	- 0 -
$\bar{A}5(\theta_4)$	- 0 -
$\bar{A}5(\theta_5)$	- 0 -
$\bar{A}6$	$p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\beta}\alpha+\mathbf{P}^{*T}_{\theta\mid\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+\ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\mid\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\mid\bar{\beta}}\alpha+\mathbf{P}^{*T}_{\theta\mid\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]$ $-\varepsilon-d_1C^I$

Figure 6-2B
Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision Prior to Invitation When the Search Condition Holds: BAM



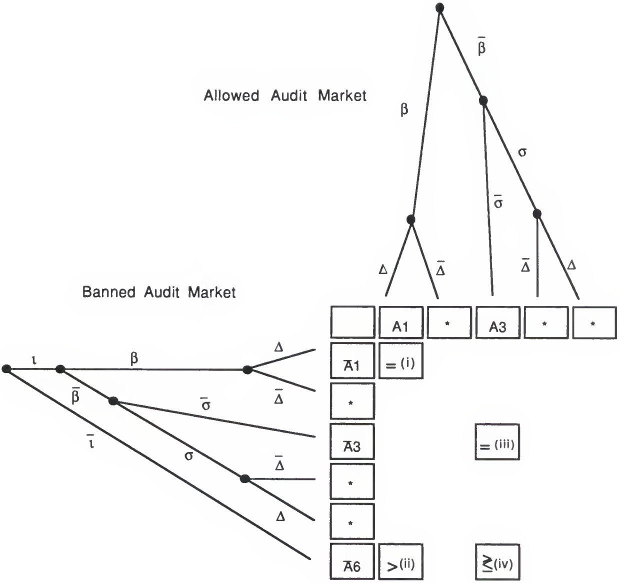
Outcome	Discounted Sum of Incumbent Profits in Periods 0,...,∞
$\bar{A}1(\theta_2)$	- 0 -
$\bar{A}1(\theta_3)$	- 0 -
$\bar{A}1(\theta_4)$	- 0 -
$\bar{A}1(\theta_5)$	- 0 -
$\bar{A}2(\theta_1)$	$- d_1\rho_i + S^*$
$\bar{A}3$	$\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$ $- \varepsilon - d_1C^I$
$\bar{A}6$	$p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+\ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]$ $- \varepsilon - d_1C^I$

Figure 6-2C
Incumbent Profits Relevant to the Incumbent's Fee-Setting Decision Prior to Invitation When the Search Condition Does Not Hold: BAM



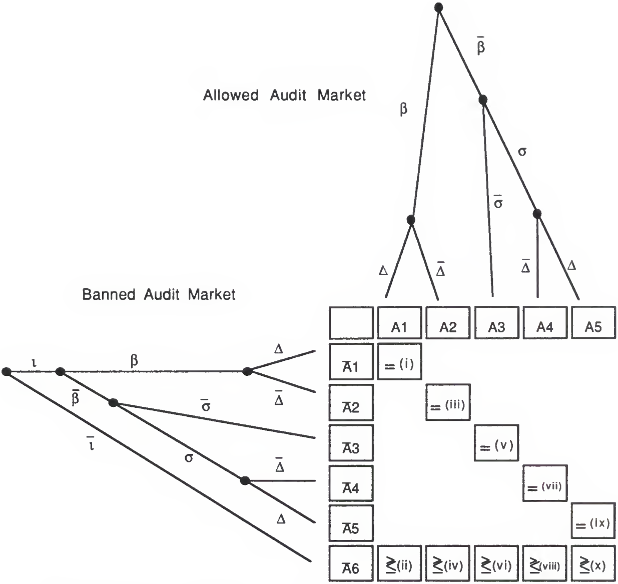
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \leq p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-3A
Summary of Period 0 Fee Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



(i) $\rho > d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.

Figure 6-3B
Summary of Period 0 Fee Differences Between the AAMS and the BAMS: Entrant Certainty Model



(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \le p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-4A
Summary of Period 1,...,∞ Fee Differences Between the AAMS and the BAMS: Entrant Uncertainty Model

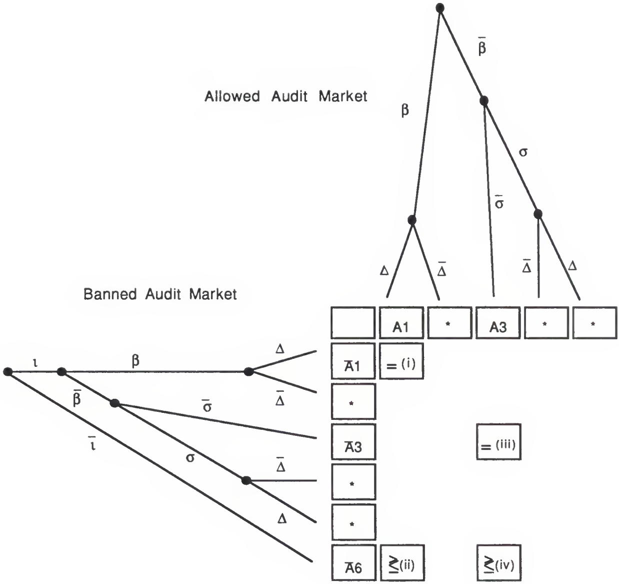


Figure 6-4B
Summary of Period 1,...,∞ Fee Differences Between the AAMS and the BAMS: Entrant Certainty Model

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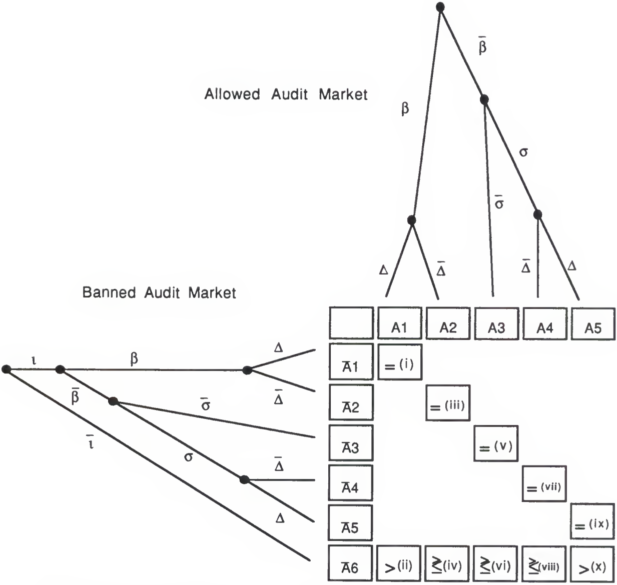
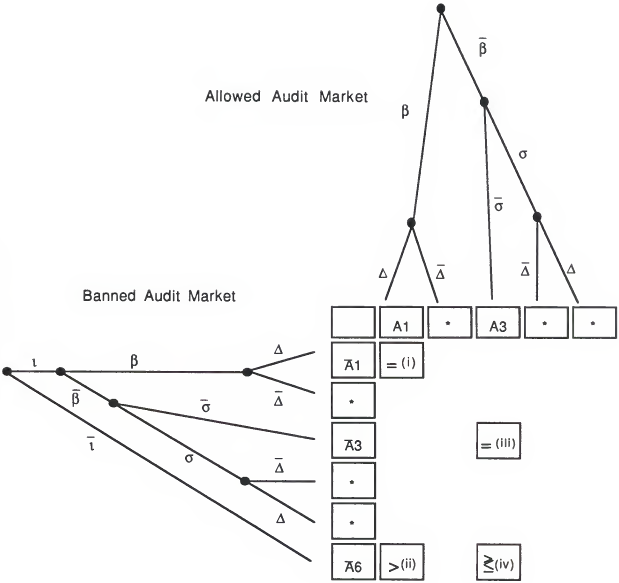
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho < d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \le p(\beta)\psi|\beta$.
(vi) $\rho < d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.



	A1	A2	A3	A4	A5
$\bar{A}1$	$=^{(i)}$				
$\bar{A}2$		$=$ (iii)			
$\bar{A}3$			$=$ (v)		
$\bar{A}4$				$=$ (vii)	
$\bar{A}5$					$=$ (ix)
$\bar{A}6$	$>^{(ii)}$	$\gtreqless$(iv)	$\gtreqless$(vi)	$\gtreqless$(viii)	$>^{(x)}$

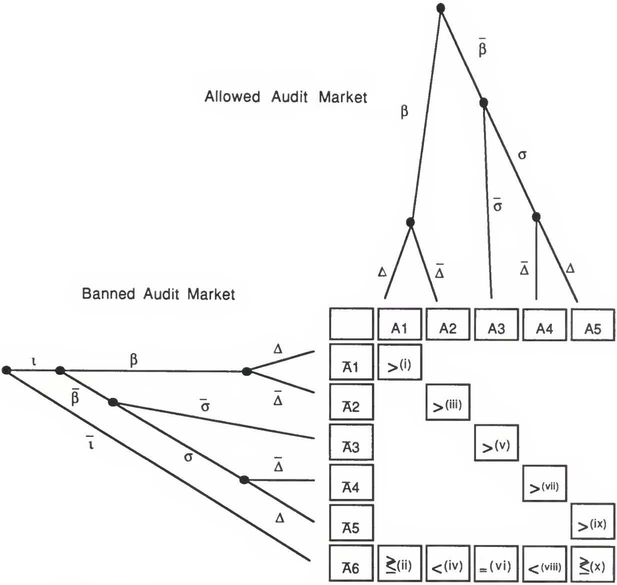
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(ii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \le p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-5A
Summary of Total Fee Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



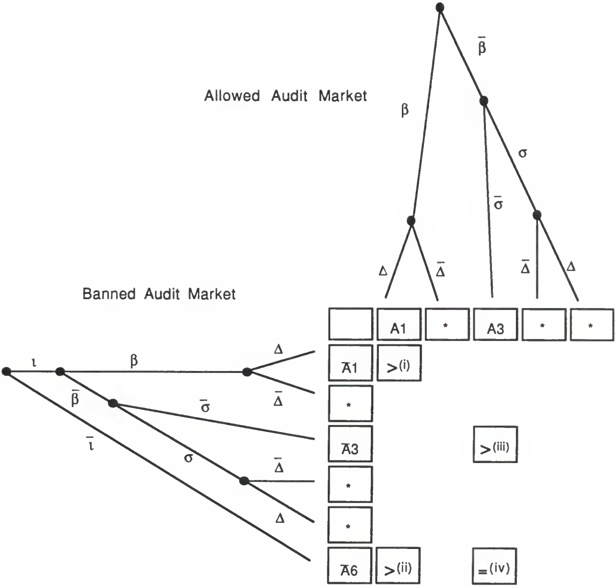
(i) $\rho > d_{10}(S^* + \varepsilon)$ and $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$ and $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.

Figure 6-5B
Summary of Total Fee Differences Between the AAMS and the BAMS: Entrant Certainty Model



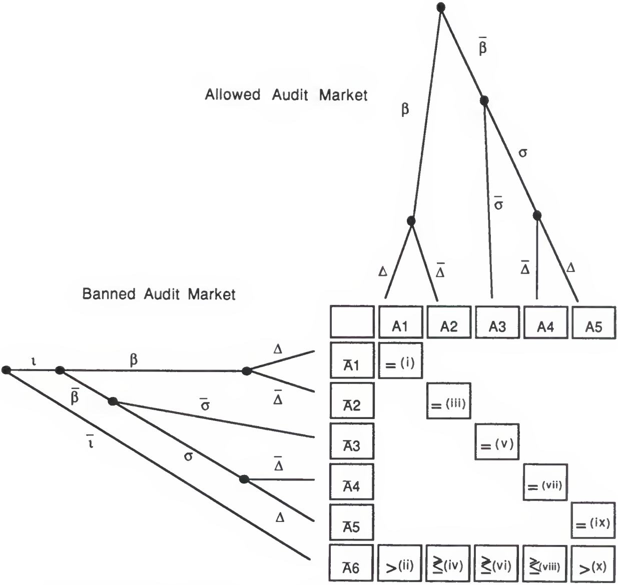
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \leq p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-6A
Summary of Total Resource Expenditure Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



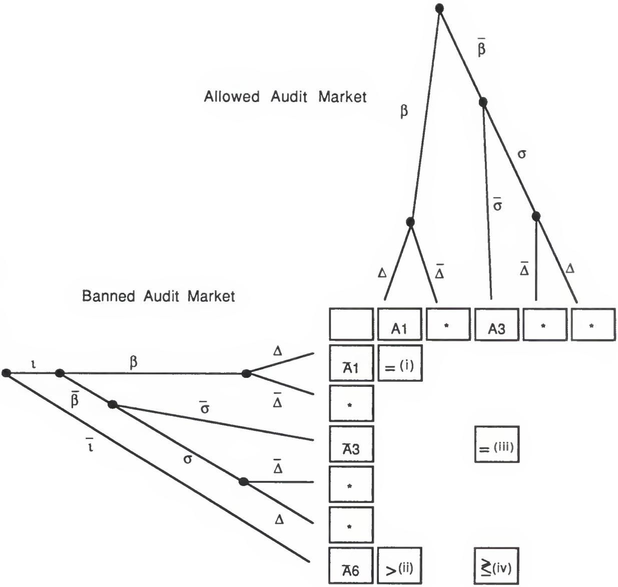
(i) $\rho > d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.

Figure 6-6B
Summary of Total Resource Expenditure Differences Between the AAMS and the BAMS: Entrant Certainty Model



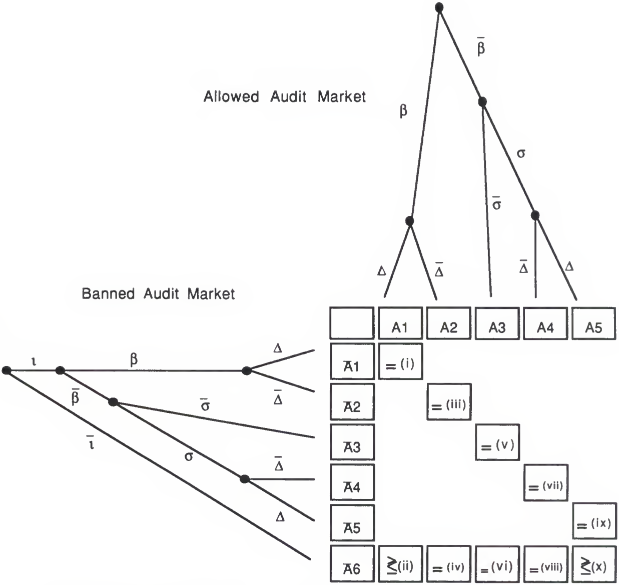
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \le p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \le \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \le \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-7A
Summary of Incumbent Profit Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



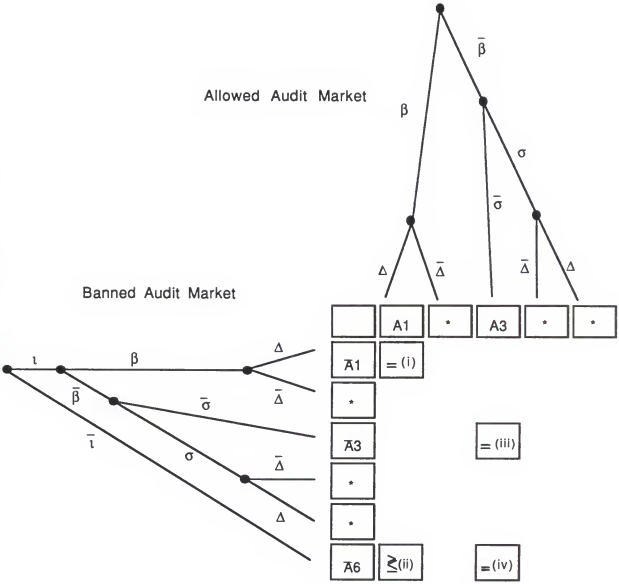
(i) $\rho > d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$ and $I \le p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.

Figure 6-7B
Summary of Incumbent Profit Differences Between the AAMS and the BAMS: Entrant Certainty Model



(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\beta)SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \leq p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-8A
Summary of Entrant 1's Profit Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



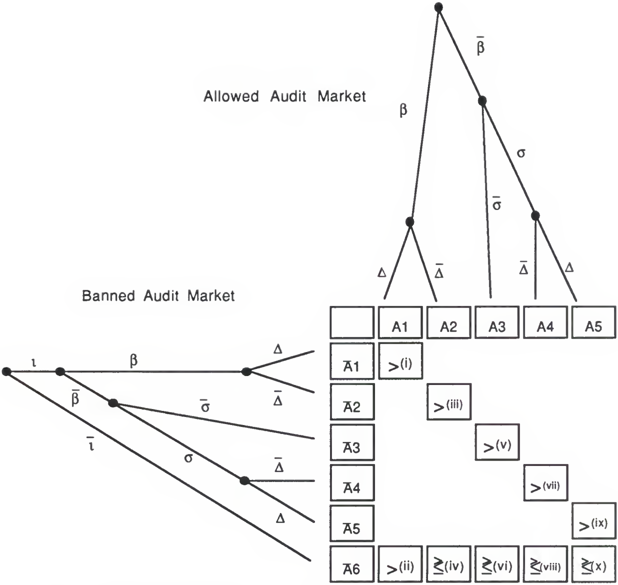
(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \le \psi$. If $SC > \psi|\bar{\beta}$, $I \le p(\beta)\psi|\beta$.

(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \le \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.

(v) $\rho < d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \le p(\beta)\psi|\beta$.

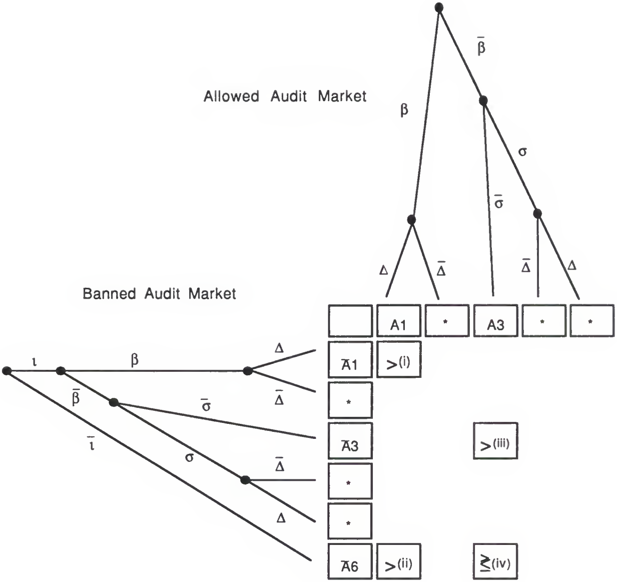
(vi) $\rho < d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.

Figure 6-8B
Summary of Entrant 1's Profit Differences Between the AAMS and the BAMS: Entrant Certainty Model



(i) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC \leq \psi$. If $SC > \psi|\bar{\beta}$, $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}(S^* + \varepsilon)$. If $SC \leq \psi|\bar{\beta}$, $I + p(\bar{\beta})SC > \psi$. If $SC > \psi|\bar{\beta}$, $I > p(\beta)\psi|\beta$.
(v) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I \leq p(\beta)\psi|\beta$.
(vi) $\rho \gtrless d_{10}(S^* + \varepsilon)$, $SC > \psi|\bar{\beta}$ and $I > p(\beta)\psi|\beta$.
(vii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(viii) $\rho < d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC < \psi$.
(ix) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC \leq \psi$.
(x) $\rho > d_{10}(S^* + \varepsilon)$, $SC \leq \psi|\bar{\beta}$ and $I + p(\bar{\beta})SC > \psi$.

Figure 6-9A
Summary of Client Cost Differences Between the AAMS and the BAMS: Entrant Uncertainty Model



(i) $\rho > d_{10}\,(S^* + \varepsilon)$ and $I \leq p(\beta)\psi|\beta$.
(ii) $\rho > d_{10}\,(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.
(iii) $\rho < d_{10}\,(S^* + \varepsilon)$ and $I \leq p(\beta)\psi|\beta$.
(iv) $\rho < d_{10}\,(S^* + \varepsilon)$ and $I > p(\beta)\psi|\beta$.

Figure 6-9B
Summary of Client Cost Differences Between the AAMS and the BAMS: Entrant Certainty Model

Table 6-1A
Summary of Cost, Search and Invitation Conditions Necessary for Category 1 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions		(2) Search Condition	(3) Invitation Condition
$A1(\theta_2)$ and $\bar{A}1(\theta_2)$	$d_{10}(S^* + \varepsilon) < \rho \le m$		$SC \le \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC \le \psi$ (ii)
	$\alpha = 0$	or		
	$d_{10}(S^* + \varepsilon) < \gamma \le m$		$SC > \psi\|\bar{\beta}$ (i) when	$I \le p(\beta)\psi\|\beta$ (iii)
$A1(\theta_3)$ and $\bar{A}1(\theta_3)$	$\alpha + d_{10}(S^* + \varepsilon) < \rho \le m$		$SC \le \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC \le \psi$ (ii)
	$0 \le \alpha < \rho - d_{10}(S^* + \varepsilon)$	or		
	$d_{10}(S^* + \varepsilon) < \gamma < m$		$SC > \psi\|\bar{\beta}$ (i) when	$I \le p(\beta)\psi\|\beta$ (iii)
$A1(\theta_4)$ and $\bar{A}1(\theta_4)$	$\max\ [\alpha, d_{10}(S^* + \varepsilon)] < \rho \le \alpha + d_{10}(S^* + \varepsilon)$		$SC \le \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC \le \psi$ (ii)
	$\rho - d_{10}(S^* + \varepsilon) \le \alpha \le \rho$	or		
	$0 < \gamma < d_{10}(S^* + \varepsilon)$		$SC > \psi\|\bar{\beta}$ (i) when	$I \le p(\beta)\psi\|\beta$ (iii)
$A1(\theta_5)$ and $\bar{A}1(\theta_5)$	$d_{10}(S^* + \varepsilon) < \rho \le \alpha$		$SC \le \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC \le \psi$ (ii)
	$\rho < \alpha \le m$	or		
	$-m + q < \gamma \le 0$		$SC > \psi\|\bar{\beta}$ (i) when	$I \le p(\beta)\psi\|\beta$ (iii)

(i) $\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\,(P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon$ from (6.14).

(ii) $\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$ from (6.28).

(iii) $\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j} + \varepsilon\,(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon$ from (6.31).

Table 6-1A--continued
Summary of Cost, Search and Invitation Conditions Necessary for Category 1 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions	(2) Search Condition	(3) Invitation Condition
$A2(\theta_1)$ and $\bar{A}2(\theta_1)$	$-q \le \rho < d_{10}(S^* + \varepsilon)$	$SC \le \psi\|\bar{\beta}$ (i)	$I + p(\bar{\beta})SC \le \psi$ (ii)
	$0 \le \alpha \le m$	or	
	$-q - m \le \gamma \le d_{10}(S^* + \varepsilon)$	$SC > \psi\|\bar{\beta}$ (i) when	$I \le p(\beta)\psi\|\beta$ (iii)
A3 and $\bar{A}3$	None	$SC > \psi\|\bar{\beta}$ (i)	$I \le p(\beta)\psi\|\beta$ (iii)
$A4(\theta_1)$ and $\bar{A}4(\theta_1)$	$-q \le \rho < d_{10}(S^* + \varepsilon)$ $0 \le \alpha \le m$ $-q - m \le \gamma \le d_{10}(S^* + \varepsilon)$	$SC \le \psi\|\bar{\beta}$ (i)	$I + p(\bar{\beta})SC \le \psi$ (ii)

(i) $$\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i\text{-}j} + \varepsilon\,(P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon \text{ from } (6.14).$$

(ii) $$\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i\text{-}j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i\text{-}j}) \text{ from } (6.28).$$

(iii) $$\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i\text{-}j} + \varepsilon\,(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon \text{ from } (6.31).$$

Table 6-1A-continued

Summary of Cost, Search and Invitation Conditions Necessary for Category 1 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions	(2) Search Condition	(3) Invitation Condition
$A5(\theta_2)$ and $\bar{A}5(\theta_2)$	$d_{10}(S^* + \varepsilon) < \rho \leq m$ $\alpha = 0$ $d_{10}(S^* + \varepsilon) < \gamma \leq m$	$SC \leq \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_3)$ and $\bar{A}5(\theta_3)$	$\alpha + d_{10}(S^* + \varepsilon) < \rho \leq m$ $0 \leq \alpha < \rho - d_{10}(S^* + \varepsilon)$ $d_{10}(S^* + \varepsilon) < \gamma < m$	$SC \leq \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_4)$ and $\bar{A}5(\theta_4)$	$\max\ [\alpha,\ d_{10}(S^* + \varepsilon)] < \rho \leq \alpha + d_{10}(S^* + \varepsilon)$ $\rho - d_{10}(S^* + \varepsilon) \leq \alpha \leq \rho$ $0 < \gamma < d_{10}(S^* + \varepsilon)$	$SC \leq \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_5)$ and $\bar{A}5(\theta_5)$	$d_{10}(S^* + \varepsilon) < \rho \leq \alpha$ $\rho < \alpha \leq m$ $-m + q < \gamma \leq 0$	$SC \leq \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)

(i) $\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\ (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon$ from (6.14).

(ii) $\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$ from (6.28).

Table 6-1B
Summary of Cost, Search and Invitation Conditions Necessary for Category 2 and 3 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions		(2) Search Condition	(3) Invitation Condition
$A1(\theta_2)$ and $\bar{A}6$	$d_{10}(S^* + \varepsilon) < \rho \leq m$		$SC \leq \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC > \psi$ (ii)
	$\alpha = 0$	or		
	$d_{10}(S^* + \varepsilon) < \gamma \leq m$		$SC > \psi\|\bar{\beta}$ (i) when	$I > p(\beta)\psi\|\beta$ (iii)
$A1(\theta_3)$ and $\bar{A}6$	$\alpha + d_{10}(S^* + \varepsilon) < \rho \leq m$		$SC \leq \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC > \psi$ (ii)
	$0 \leq \alpha < \rho - d_{10}(S^* + \varepsilon)$	or		
	$d_{10}(S^* + \varepsilon) < \gamma < m$		$SC > \psi\|\bar{\beta}$ (i) when	$I > p(\beta)\psi\|\beta$ (iii)
$A1(\theta_4)$ and $\bar{A}6$	$\max\ [\alpha,\ d_{10}(S^* + \varepsilon)] < \rho \leq \alpha + d_{10}(S^* + \varepsilon)$		$SC \leq \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC > \psi$ (ii)
	$\rho - d_{10}(S^* + \varepsilon) \leq \alpha \leq \rho$	or		
	$0 < \gamma < d_{10}(S^* + \varepsilon)$		$SC > \psi\|\bar{\beta}$ (i) when	$I > p(\beta)\psi\|\beta$ (iii)
$A1(\theta_5)$ and $\bar{A}6$	$d_{10}(S^* + \varepsilon) < \rho \leq \alpha$		$SC \leq \psi\|\bar{\beta}$ (i) when	$I + p(\bar{\beta})SC > \psi$ (ii)
	$\rho < \alpha \leq m$	or		
	$-m + q < \gamma \leq 0$		$SC > \psi\|\bar{\beta}$ (i) when	$I > p(\beta)\psi\|\beta$ (iii)

(i) $\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\ (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon$ from (6.14).

(ii) $\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$ from (6.28).

(iii) $\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta) y_{i-j} + \varepsilon\ (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon$ from (6.31).

Table 6-1B--continued
Summary of Cost, Search and Invitation Conditions Necessary for Category 2 and 3 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions	(2) Search Condition	(3) Invitation Condition
$A2(\theta_1)$ and $\bar{A}6$	$-q \le \rho < d_{10}(S^* + \varepsilon)$	$SC \le \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
	$0 \le \alpha \le m$	or	
	$-q - m \le \gamma \le d_{10}(S^* + \varepsilon)$	$SC > \psi\vert\bar{\beta}$ (i) when	$I > p(\beta)\psi\vert\beta$ (iii)
A3 and $\bar{A}6$	None	$SC > \psi\vert\bar{\beta}$ (i)	$I > p(\beta)\psi\vert\beta$ (iii)
$A4(\theta_1)$ and $\bar{A}6$	$-q \le \rho < d_{10}(S^* + \varepsilon)$ $0 \le \alpha \le m$ $-q - m \le \gamma \le d_{10}(S^* + \varepsilon)$	$SC \le \psi\vert\bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)

(i) $\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\,(P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon$ from (6.14).

(ii) $\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)(y_{i-j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)(y_{i-j})$ from (6.28).

(iii) $\psi|\beta = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\beta) y_{i-j} + \varepsilon\,(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon$ from (6.31).

Table 6-1B--continued

Summary of Cost, Search and Invitation Conditions Necessary for Category 2 and 3 Comparisons

Decision-Cost Combination Comparison	(1) Cost Conditions	(2) Search Condition	(3) Invitation Condition
$A5(\theta_2)$ and $\bar{A}6$	$d_{10}(S^* + \varepsilon) < \rho \leq m$ $\alpha = 0$ $d_{10}(S^* + \varepsilon) < \gamma \leq m$	$SC \leq \psi \vert \bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_3)$ and $\bar{A}6$	$\alpha + d_{10}(S^* + \varepsilon) < \rho \leq m$ $0 \leq \alpha < \rho - d_{10}(S^* + \varepsilon)$ $d_{10}(S^* + \varepsilon) < \gamma < m$	$SC \leq \psi \vert \bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_4)$ and $\bar{A}6$	$\max\ [\alpha, d_{10}(S^* + \varepsilon)] < \rho \leq \alpha + d_{10}(S^* + \varepsilon)$ $\rho - d_{10}(S^* + \varepsilon) \leq \alpha \leq \rho$ $0 < \gamma < d_{10}(S^* + \varepsilon)$	$SC \leq \psi \vert \bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)
$A5(\theta_5)$ and $\bar{A}6$	$d_{10}(S^* + \varepsilon) < \rho \leq \alpha$ $\rho < \alpha \leq m$ $-m + q < \gamma \leq 0$	$SC \leq \psi \vert \bar{\beta}$ (i)	$I + p(\bar{\beta})SC > \psi$ (ii)

(i) $\psi|\bar{\beta} = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\bar{\beta}) y_{i-j} + \varepsilon\ (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon$ from (6.14).

(ii) $\psi = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j)(z_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j}) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)(y_{i-j})$ from (6.28).

Table 6-2
Differences in Fees, Profits and Resource Expenditures Between the Banned Audit Market and the Allowed Audit Market Assuming Invitation in the Banned Audit Market

	Description	Difference	Sign of Difference
1	Period 0 Fee	None	=
2	Fee in Periods $1, \ldots, \infty$	None	=
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2\ (2)]$	None	=
4	Discounted Sum of Production Costs in Periods $0,\ldots,\infty$	None	=
5	Other Audit Firm Costs	None	=
6	Non-fee Client Costs	I	>
7	Discounted Sum of Client Costs in Periods $0,\ldots,\infty$ $(3 + 6)$	I	>
8	Discounted Sum of Total Resources Expended in Periods $0,\ldots,\infty$ $(4 + 5 + 6)$	I	>
9	Discounted Sum of Incumbent's Profits in Periods $0,\ldots,\infty$	None	=
10	Discounted Sum of Entrant 1's Profits in Periods $0,\ldots,\infty$	None	=

Table 6-3
Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A1(\theta_2)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$\rho_i - S + d_7 S^* + d_{10} I$ $+ p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
2	Fee in Periods 1, ... ,∞	$\rho_i - d_{10} S^* + d_{10} I$ $+ p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$d_1 \rho_i - S + I$ $+ p(\beta) SC + d_1 \phi - \psi$	>
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1 \rho_i - S$	>
5	Other Audit Firm Costs	$-nG$	<
6	Non-fee Client Costs	$-SW$	<
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - S^* - \varepsilon + I$ $+ p(\beta) SC + d_1 \phi - \psi$	>
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1 \rho_i - S^* - \varepsilon - nG$	≥(i) < (ii)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1 \phi - \psi$	>
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	G	>

(i) The sign of the difference is ≥ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} nG$.

(ii) The sign of the difference is < for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} nG$.

Table 6-4

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A1(\theta_3)$

Description	Difference	Sign of Difference
1 Period 0 Fee	$\rho_i - \alpha j - d_{10} S^* + SW$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
2 Fee in Periods 1, ... ,∞	$\rho_i - \alpha j - d_{10} S^*$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$d_1 \rho_i - d_1 \alpha j - S + \varepsilon$ $+ I + p(\beta) SC + d_1 \phi - \psi$	>
4 Discounted Sum of Production Costs in Periods 0,...,∞	$d_1 \rho_i - S$	>
5 Other Audit Firm Costs	$-nG$	<
6 Non-fee Client Costs	$-SW$	<
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - d_1 \alpha j - S^*$ $+ I + p(\beta) SC + d_1 \phi - \psi$	>
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1 \rho_i - S^* - \varepsilon - nG$	≥ (i) < (ii)
9 Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1 \phi - \psi$	>
10 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1 \alpha j + G + \varepsilon$	≥ (iii) < (iv)

(i) The sign of the difference is ≥ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} nG$.

(ii) The sign of the difference is < for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} nG$.

(iii) The sign of the difference is ≥ for $\alpha_j \leq d_{10} (G + \varepsilon)$.

(iv) The sign of the difference is < for $\alpha_j > d_{10} (G + \varepsilon)$.

Table 6-5

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A1(\theta_4)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$-d_2\rho_i + d_2\alpha j + d_7 S^* + SW + \varepsilon$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10}\psi$	$>$
2	Fee in Periods 1, ... ,∞	$\rho_i - \alpha j - d_{10} S^*$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10}\psi$	$>$
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2\ (2)]$	$SW + \varepsilon$ $+ I + p(\beta) SC + d_1\phi - \psi$	$>$
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1\rho_i - S$	$>$
5	Other Audit Firm Costs	$-nG$	$<$
6	Non-fee Client Costs	$-SW$	$<$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$I + p(\beta) SC + d_1\phi - \psi + \varepsilon$	$>$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1\rho_i - S^* - \varepsilon - nG$	$\geq$ (i) $<$ (ii)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1\phi - \psi$	$>$
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1\rho_i + S^* + G + 2\varepsilon$	$\geq$ (iii) $<$ (iv)

(i) The sign of the difference is ≥ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} nG$.

(ii) The sign of the difference is < for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} nG$.

(iii) The sign of the difference is ≥ for $\rho_i \leq d_{10} (S^* + \varepsilon) + d_{10} (G + \varepsilon)$.

(iv) The sign of the difference is < for $\rho_i > d_{10} (S^* + \varepsilon) + d_{10} (G + \varepsilon)$.

Table 6-6

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A1(\theta_5)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$d_7 S^* + SW + \varepsilon$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$>$
2	Fee in Periods 1, ... ,∞	$- d_{10} S^*$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$SW + \varepsilon$ $+ I + p(\beta) SC + d_1 \phi - \psi$	$>$
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1 \rho_i - S$	$>$
5	Other Audit Firm Costs	$-nG$	$<$
6	Non-fee Client Costs	$-SW$	$<$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$I + p(\beta) SC + d_1 \phi - \psi + \varepsilon$	$>$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1 \rho_i - S^* - \varepsilon - nG$	$\geq$ (iii) $<$ (iv)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1 \phi - \psi$	$>$
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1 \rho_i + S^* + G + 2\varepsilon$	$\geq$ (v) $<$ (vi)

(i) The sign of the difference is $\geq$ for $\phi \geq d_{10} S^*$ when $SC \leq \psi/\beta$ and the sign of the difference is $\geq$ for $\phi \geq d_{10} S^* - p(\beta) d_{10} [SC^+]$ when $SC > \psi/\beta$.

(ii) The sign of the difference is $<$ for $\phi < d_{10} S^*$ when $SC \leq \psi/\beta$ and the sign of the difference is $<$ for $\phi < d_{10} S^* - p(\beta) d_{10} [SC^+]$ when $SC > \psi/\beta$.

(iii) The sign of the difference is $\geq$ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} nG$.

(iv) The sign of the difference is $<$ for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} nG$.

(v) The sign of the difference is $\geq$ for $\rho_i \leq d_{10} (S^* + \varepsilon) + d_{10} (G + \varepsilon)$.

(vi) The sign of the difference is $<$ for $\rho_i > d_{10} (S^* + \varepsilon) + d_{10} (G + \varepsilon)$.

Table 6-7
Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A2(\theta_1)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$\rho_i - d_{10} S^*$ $+d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
2	Fee in Periods 1, ... ,∞	$\rho_i - d_{10} S^*$ $+d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$d_1 \rho_i - S^*$ $+ I + p(\beta) SC + d_1 \phi - \psi$	$\geq$(i) $<$(ii)
4	Discounted Sum of Production Costs in Periods 0,...,∞	None	=
5	Other Audit Firm Costs	$-nG$	$<$
6	Non-fee Client Costs	None	=
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - S^*$ $I + p(\beta) SC + d_1 \phi - \psi$	$\geq$(i) $<$ (ii)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$-nG$	$<$
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$d_1 \rho_i - S^*$ $I + p(\beta) SC + d_1 \phi - \psi$	$\geq$(i) $<$ (ii)
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	G	$>$

(i) The sign of the difference is $\geq$ for $x_i \leq \phi + d_{10} \varepsilon$ when $SC \leq \psi|\beta$ and the sign of the difference is $\geq$ for $x_i \leq \phi + d_{10} \varepsilon + p(\beta) d_{10} [SC^+]$ when $SC > \psi|\beta$.

(ii) The sign of the difference is $<$ for $x_i > \phi + d_{10} \varepsilon$ when $SC \leq \psi|\beta$ and the sign of the difference is $<$ for $x_i > \phi + d_{10} \varepsilon + p(\beta) d_{10} [SC^+]$ when $SC > \psi|\beta$.

Table 6-8

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A4(\theta_1)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$\rho_i - d_{10} S^*$ $+ d_{10} I + p(\bar{\beta}) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
2	Fee in Periods 1, ... ,∞	$\rho_i - d_{10} S^*$ $+ d_{10} I + p(\bar{\beta}) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$d_1 \rho_i - S^*$ $+ I + p(\bar{\beta}) SC + d_1 \phi - \psi$	$\geq$ (i) $<$ (ii)
4	Discounted Sum of Production Costs in Periods 0,...,∞	None	=
5	Other Audit Firm Costs	None	=
6	Non-fee Client Costs	-SC	<
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - S^* - SC$ $I + p(\bar{\beta}) SC + d_1 \phi - \psi$	$\geq$ (iii) $<$ (iv)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	- SC	<
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$d_1 \rho_i - S^*$ $I + p(\bar{\beta}) SC + d_1 \phi - \psi$	$\geq$ (i) $<$ (ii)
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	None	=

(i) The sign of the difference is $\geq$ for $x_i \leq \phi + d_{10} \varepsilon$.

(ii) The sign of the difference is $<$ for $x_i > \phi + d_{10} \varepsilon$.

(iii) The sign of the difference is $\geq$ for $x_i \leq \phi + d_{10} \varepsilon - d_{10} SC$.

(iv) The sign of the difference is $<$ for $x_i > \phi + d_{10} \varepsilon - d_{10} SC$.

Table 6-9

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A5(\theta_2)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$\rho_i - S + d_7 S^* + d_{10} I$ $+ p(\beta) d_{10} SC + \phi - d_{10} \psi$	$>$
2	Fee in Periods 1, ... ,∞	$\rho_i - d_{10} S^* + d_{10} I$ $+ p(\beta) d_{10} SC + \phi - d_{10} \psi$	$>$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$d_1 \rho_i - S + I$ $+ p(\beta) SC + d_1 \phi - \psi$	$>$
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1 \rho_i - S$	$>$
5	Other Audit Firm Costs	None	$=$
6	Non-fee Client Costs	$-SW-SC$	$<$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - S^* - SC - \varepsilon$ $+ I + p(\beta) SC + d_1 \phi - \psi$	$\geq$ (i) $<$ (ii)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1 \rho_i - S^* - \varepsilon - SC$	$\geq$ (iii) $<$ (iv)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1 \phi - \psi$	$>$
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	None	$=$

(i) The sign of the difference is $\geq$ for $SC \leq d_1 z_i + d_1 \phi$.

(ii) The sign of the difference is $<$ for $SC > d_1 z_i + d_1 \phi$.

(iii) The sign of the difference is $\geq$ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} SC$.

(iv) The sign of the difference is $<$ for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} SC$.

Table 6-10

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A5(\theta_3)$

Description	Difference	Sign of Difference
1 Period 0 Fee	$\rho_i - \alpha_j - d_{10} S^* + SW$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
2 Fee in Periods 1, ... ,∞	$\rho_i - \alpha_j - d_{10} S^*$ $+ d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	>
3 Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2 \ (2)]$	$d_1 \rho_i - d_1 \alpha_j - S + \varepsilon$ $+ I + p(\beta) SC + d_1 \phi - \psi$	>
4 Discounted Sum of Production Costs in Periods 0,...,∞	$d_1 \rho_i - S$	>
5 Other Audit Firm Costs	None	=
6 Non-fee Client Costs	$-SW-SC$	<
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1 \rho_i - d_1 \alpha_j - S^* - SC$ $+ I + p(\beta) SC + d_1 \phi - \psi$	≥ (i) < (ii)
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1 \rho_i - S^* - \varepsilon - SC$	≥ (iii) < (iv)
9 Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1 \phi - \psi$	>
10 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1 \alpha_j + \varepsilon$	≥ (v) < (vi)

(i) The sign of the difference is ≥ for $SC \leq d_1 y_{i\text{-}j} + \varepsilon + d_1 \phi$.

(ii) The sign of the difference is < for $SC > d_1 y_{i\text{-}j} + \varepsilon + d_1 \phi$.

(iii) The sign of the difference is ≥ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} SC$.

(iv) The sign of the difference is < for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} SC$.

(v) The sign of the difference is ≥ for $\alpha_j \leq d_{10} \varepsilon$.

(vi) The sign of the difference is < for $\alpha_j > d_{10} \varepsilon$.

Table 6-11

Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and $A5(\theta_4)$

	Description	Difference	Sign of Difference
1	Period 0 Fee	$-d_2\rho_i + d_2\alpha j + d_7S^* + SW + \varepsilon + d_{10} I + p(\beta) d_{10} SC + \phi - d_{10}\psi$	$>$
2	Fee in Periods 1, ... ,∞	$\rho_i - \alpha j - d_{10} S^* + d_{10} I + p(\beta) d_{10} SC + \phi - d_{10}\psi$	$>$
3	Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2 \ (2)]$	$SW + \varepsilon + I + p(\beta)SC + d_1\phi - \psi$	$>$
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1\rho_i - S$	$>$
5	Other Audit Firm Costs	None	$=$
6	Non-fee Client Costs	$-SW - SC$	$<$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$-SC + \varepsilon + I + p(\beta)SC + d_1\phi - \psi$	$\geq$ (i) $<$ (ii)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1\rho_i - S^* - \varepsilon - SC$	$\geq$ (iii) $<$ (iv)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1\phi - \psi$	$>$
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1\rho_i + S^* + 2\varepsilon$	$\geq$ (v) $<$ (vi)

(i) The sign of the difference is $\geq$ for $SC \leq d_1\phi + \varepsilon$.

(ii) The sign of the difference is $<$ for $SC > d_1\phi + \varepsilon$.

(iii) The sign of the difference is $\geq$ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10}SC$.

(iv) The sign of the difference is $<$ for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10}SC$.

(v) The sign of the difference is $\geq$ for $\rho_i \leq d_{10} (S^* + \varepsilon) + d_{10}\varepsilon$.

(vi) The sign of the difference is $<$ for $\rho_i > d_{10} (S^* + \varepsilon) + d_{10}\varepsilon$.

Table 6-12
Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and A5(θ_5)

	Description	Difference	Sign of Difference
1	Period 0 Fee	$d_7S^* + SW + \varepsilon$ $+d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$>$
2	Fee in Periods 1, ... ,∞	$- d_{10} S^*$ $+d_{10} I + p(\beta) d_{10} SC + \phi - d_{10} \psi$	$\geq$ (i) $<$ (ii)
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$SW + \varepsilon$ $+ I + p(\beta)SC + d_1\phi - \psi$	$>$
4	Discounted Sum of Production Costs in Periods 0,...,∞	$d_1\rho_i - S$	$>$
5	Other Audit Firm Costs	None	$=$
6	Non-fee Client Costs	$-SW - SC$	$<$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$-SC + \varepsilon$ $I + p(\beta)SC + d_1\phi - \psi$	$\geq$ (iii) $<$ (iv)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	$d_1\rho_i - S^* - \varepsilon - SC$	$\geq$ (v) $<$ (vi)
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$I + p(\beta) SC + d_1\phi - \psi$	$>$
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	$-d_1\rho_i + S^* + 2\varepsilon$	$\geq$ (vii) $<$ (viii)

(i) The sign of the difference is $\geq$ for $\phi \geq d_{10} S^*$.

(ii) The sign of the difference is $<$ for $\phi < d_{10} S^*$.

(iii) The sign of the difference is $\geq$ for $SC \leq d_1\phi + \varepsilon$.

(iv) The sign of the difference is $<$ for $SC > d_1\phi + \varepsilon$.

(v) The sign of the difference is $\geq$ for $\rho_i \geq d_{10} (S^* + \varepsilon) + d_{10} SC$.

(vi) The sign of the difference is $<$ for $\rho_i < d_{10} (S^* + \varepsilon) + d_{10} SC$.

(vii) The sign of the difference is $\geq$ for $\rho_i \leq d_{10} (S^* + \varepsilon) + d_{10} \varepsilon$.

(viii) The sign of the difference is $<$ for $\rho_i > d_{10} (S^* + \varepsilon) + d_{10} \varepsilon$.

Table 6-13
Differences in Fee, Profit and Resource Expenditure Outcomes: $\bar{A}6$ and A3

	Description	Difference	Sign of Difference
1	Period 0 Fee	$- p(\beta)[\phi\vert\bar{\beta} - \phi\vert\beta] - p(\beta) d_{10}\, \psi\vert\beta$ $- p(\beta) d_{10} [SC^{+}] + d_{10}\, I$	$\geq$ (i) $<$ (ii)
2	Fee in Periods 1, ... ,∞	$- p(\beta)[\phi\vert\bar{\beta} - \phi\vert\beta] - p(\beta) d_{10}\, \psi\vert\beta$ $- p(\beta) d_{10} [SC^{+}] + d_{10}\, I$	$\geq$ (i) $<$ (ii)
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2 (2)]	$- p(\beta) d_1 [\phi\vert\bar{\beta} - \phi\vert\beta] - p(\beta)\psi\vert\beta$ $- p(\beta)[SC^{+}] + I$	$\geq$ (i) $<$ (ii)
4	Discounted Sum of Production Costs in Periods 0,...,∞	None	=
5	Other Audit Firm Costs	None	=
6	Non-fee Client Costs	None	=
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$- p(\beta) d_1 [\phi\vert\bar{\beta} - \phi\vert\beta] - p(\beta)\psi\vert\beta$ $- p(\beta)[SC^{+}] + I$	$\geq$ (i) $<$ (ii)
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4 + 5 + 6)	None	=
9	Discounted Sum of Incumbent's Profits in Periods 0,...,∞	$- p(\beta) d_1 [\phi\vert\bar{\beta} - \phi\vert\beta] - p(\beta)\psi\vert\beta$ $- p(\beta)[SC^{+}] + I$	$\geq$ (i) $<$ (ii)
10	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞	None	=

(i) The sign of the difference is $\geq$ for $I > p(\beta)\left[d_1(\phi\vert\bar{\beta} - \phi\vert\beta) + \psi\vert\beta + SC^{+}\right]$.

(ii) The sign of the difference is $<$ for $I < p(\beta)\left[d_1(\phi\vert\bar{\beta} - \phi\vert\beta) + \psi\vert\beta + SC^{+}\right]$.

Table 6-14A

Summary of Period 0, Period 1,...,∞ and Total Fee, Differences Between the AAMS and the BAMS: Entrant Uncertainty

	θ_1			θ_2			θ_3			θ_4			θ_5		
	Period			Period			Period			Period			Period		
Combination	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total
A1 & Ā1 A2 & Ā2 A3 & Ā3 A4 & Ā4 A5 & Ā5	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Ā6 & A1	*	*	*	>	>	>	>	>	>	>	>	>	>	$\gtreqless$(i)	>
Ā6 & A2	$\gtreqless$(ii)	$\gtreqless$(ii)	$\gtreqless$(ii)	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A3(iii)	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$	$\gtreqless$
Ā6 & A4	$\gtreqless$(iv)	$\gtreqless$(iv)	$\gtreqless$(iv)	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A5	*	*	*	>	>	>	>	>	>	>	>	>	>	$\gtreqless$(v)	>

(i) The sign of the difference is ≥ for $\phi \geq d_{10} S^*$ when $SC \leq \psi|\bar{\beta}$ and the sign of the difference is ≥ for $\phi \geq d_{10} S^* - p(\beta) d_{10} [SC^+]$ when $SC > \psi|\bar{\beta}$. The sign of the difference is < for $\phi < d_{10} S^*$ when $SC \leq \psi|\bar{\beta}$ and the sign of the difference is < for $\phi < d_{10} S^* - p(\beta) d_{10} [SC^+]$ when $SC > \psi|\bar{\beta}$.

(ii) The sign of the difference is ≥ for $x_i \leq \phi + d_{10}\varepsilon$ when $SC \leq \psi|\bar{\beta}$ and the sign of the difference is ≥ for $x_i \leq \phi + d_{10}\varepsilon + p(\beta) d_{10} [SC^+]$ when $SC > \psi|\bar{\beta}$. The sign of the difference is < for $x_i > \phi + d_{10}\varepsilon$ when $SC \leq \psi|\bar{\beta}$ and the sign of the difference is < for $x_i > \phi + d_{10}\varepsilon + p(\beta) d_{10} [SC^+]$ when $SC > \psi|\bar{\beta}$.

(iii) The sign of the difference is ≥ for $I > p(\beta)\left[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta + SC^+\right]$. The sign of the difference is < for $I < p(\beta)\left[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta + SC^+\right]$.

(iv) The sign of the difference is ≥ for $x_i \leq \phi + d_{10}\varepsilon$. The sign of the difference is < for $x_i > \phi + d_{10}\varepsilon$.

(v) The sign of the difference is ≥ for $\phi \geq d_{10} S^*$. The sign of the difference is < for $\phi < d_{10} S^*$.

Table 6-14B
Summary of Period 0, Period 1,...,∞ and Total Fee, Differences Between the AAMS and the BAMS: Entrant Certainty Model

	θ_1			θ_2			θ_3			θ_4			θ_5		
	Period			Period			Period			Period			Period		
Combination	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total	0	1,...,∞	Total
A1 & Ā1 A2 & Ā2 A3 & Ā3	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
A4 & Ā4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
A5 & Ā5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A1	*	*	*	>	>	>	>	>	>	>	>	>	>	$\gtreqless$(i)	>
Ā6 & A2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A3(ii)	$\gtreqless$	$\gtreqless$	$\gtreqless$	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

(i) The sign of the difference is ≥ for $\phi \geq d_{10} S^* - p(\beta) d_{10}$ [SC]. The sign of the difference is < for $\phi < d_{10} S^* - p(\beta) d_{10}$ [SC].

(ii) The sign of the difference is ≥ for $I > p(\beta)\left[d_1(\phi|\beta) + \psi|\beta + SC\right]$. The sign of the difference is < for $I < p(\beta)\left[d_1(\phi|\beta) + \psi|\beta + SC\right]$.

Table 6-15A

Summary of Resource Expenditure Outcome Differences Between the AAMS and the BAMS:Entrant Uncertainty

	θ_1			θ_2			θ_3			θ_4			θ_5		
Combination	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total
A1 & $\bar{A}$1 A2 & $\bar{A}$2 A3 & $\bar{A}$3 A4 & $\bar{A}$4 A5 & $\bar{A}$5	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>
$\bar{A}$6 & A1	*	*	*	>	<	$\gtreqless^{(i)}$	>	<	$\gtreqless^{(i)}$	>	<	$\gtreqless^{(i)}$	>	<	$\gtreqless^{(i)}$
$\bar{A}$6 & A2	=	<	<	*	*	*	*	*	*	*	*	*	*	*	*
$\bar{A}$6 & A3	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
$\bar{A}$6 & A4	=	=	=	*	*	*	*	*	*	*	*	*	*	*	*
$\bar{A}$6 & A5	*	*	*	>	=	$\gtreqless^{(ii)}$	>	=	$\gtreqless^{(ii)}$	>	=	$\gtreqless^{(ii)}$	>	=	$\gtreqless^{(ii)}$

(i) The sign of the difference is ≥ for $\rho_i \geq d_{10}(S^* + \varepsilon) + d_{10}nG$. The sign of the difference is < for $\rho_i < d_{10}(S^* + \varepsilon) + d_{10}nG$.

(ii) The sign of the difference is ≥ for $\rho_i \geq d_{10}(S^* + \varepsilon) + d_{10}SC$. The sign of the difference is < for $\rho_i < d_{10}(S^* + \varepsilon) + d_{10}SC$.

Table 6-15B
Summary of Resource Expenditure Outcome Differences Between the AAMS and the BAMS: Entrant Certainty

	θ_1			θ_2			θ_3			θ_4			θ_5		
Combination	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total	Audit Firm Prod. Costs	Other Costs	Total
A1 & Ā1 A2 & Ā2 A3 & Ā3	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>
A4 & Ā4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
A5 & Ā5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A1	*	*	*	>	<	>	>	<	>	>	<	>	>	<	>
Ā6 & A2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A3	=	=	=	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ā6 & A5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 6-16A

Summary of Profit Differences Between the AAMS and the BAMS: Entrant Uncertainty

Combination	Incumbent Profit Differences					Entrant 1 Profit Differences					Client Cost Differences				
	θ_1	θ_2	θ_3	θ_4	θ_5	θ_1	θ_2	θ_3	θ_4	θ_5	θ_1	θ_2	θ_3	θ_4	θ_5
A1 & Ā1 A2 & Ā2 A3 & Ā3 A4 & Ā4 A5 & Ā5	=	=	=	=	=	=	=	=	=	=	>	>	>	>	>
Ā6 & A1	*	>	>	>	>	*	>	$\gtreqless$ (i)	$\gtreqless$ (ii)	$\gtreqless$ (ii)	*	>	>	>	>
Ā6 & A2	$\gtreqless$ (iii)	*	*	*	*	=	*	*	*	*	$\gtreqless$ (iii)	*	*	*	*
Ā6 & A3	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)	=	=	=	=	=	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)	$\gtreqless$ (iv)
Ā6 & A4	$\gtreqless$ (v)	*	*	*	*	=	*	*	*	*	$\gtreqless$ (vi)	*	*	*	*
Ā6 & A5	*	>	>	>	>	*	=	$\gtreqless$ (vii)	$\gtreqless$ (viii)	$\gtreqless$ (viii)	*	$\gtreqless$ (ix)	$\gtreqless$ (x)	$\gtreqless$ (xi)	$\gtreqless$ (xi)

(i) The sign of the difference is ≥ for $\alpha_j \le d_{10}(G + \varepsilon)$. The sign of the difference is < for $\alpha_j > d_{10}(G + \varepsilon)$.

(ii) The sign of the difference is ≥ for $\rho_i \le d_{10}(S^* + \varepsilon) + d_{10}(G + \varepsilon)$. The sign of the difference is < for $\rho_i > d_{10}(S^* + \varepsilon) + d_{10}(G + \varepsilon)$.

(iii) The sign of the difference is ≥ for $x_i \le \phi + d_{10}\varepsilon$ when $SC \le \psi|\bar{\beta}$ and the sign of the difference is ≥ for $x_i \le \phi + d_{10}\varepsilon + p(\bar{\beta})\, d_{10}[SC^+]$ when $SC > \psi|\bar{\beta}$. The sign of the difference is < for $x_i > \phi + d_{10}\varepsilon$ when $SC \le \psi|\bar{\beta}$ and the sign of the difference is < for $x_i > \phi + d_{10}\varepsilon + p(\bar{\beta})\, d_{10}[SC^+]$ when $SC > \psi|\bar{\beta}$.

(iv) The sign of the difference is ≥ for $I > p(\beta)[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta + SC^+]$. The sign of the difference is < for $I < p(\beta)[d_1(\phi|\bar{\beta} - \phi|\beta) + \psi|\beta + SC^+]$.

(v) The sign of the difference is ≥ for $x_i \le \phi + d_{10}\varepsilon$. The sign of the difference is < for $x_i > \phi + d_{10}\varepsilon$.

(vi) The sign of the difference is ≥ for $x_i \le \phi + d_{10}\varepsilon - d_{10}SC$. The sign of the difference is < for $x_i > \phi + d_{10}\varepsilon - d_{10}SC$.

(vii) The sign of the difference is ≥ for $\alpha_j \le d_{10}\varepsilon$. The sign of the difference is < for $\alpha_j > d_{10}\varepsilon$.

(viii) The sign of the difference is ≥ for $\rho_i \le d_{10}(S^* + \varepsilon) + d_{10}\varepsilon$. The sign of the difference is < for $\rho_i > d_{10}(S^* + \varepsilon) + d_{10}\varepsilon$.

(ix) The sign of the difference is ≥ for $SC \le d_1 z_i + d_1\phi$. The sign of the difference is < for $SC > d_1 z_i + d_1\phi$.

(x) The sign of the difference is ≥ for $SC \le d_1 y_{i\text{-}j} + \varepsilon + d_1\phi$. The sign of the difference is < for $SC > d_1 y_{i\text{-}j} + \varepsilon + d_1\phi$.

(xi) The sign of the difference is ≥ for $SC \le d_1\phi + \varepsilon$. The sign of the difference is < for $SC > d_1\phi + \varepsilon$.

Table 6-16B

Summary of Profit Differences Between the AAMS and the BAMS: Entrant Certainty

Combination	Incumbent Profit Differences					Entrant 1 Profit Differences					Client Cost Differences				
	θ_1	θ_2	θ_3	θ_4	θ_5	θ_1	θ_2	θ_3	θ_4	θ_5	θ_1	θ_2	θ_3	θ_4	θ_5
A1 & $\bar{A}$1	=	=	=	=	=	=	=	=	=	=	>	>	>	>	>
A2 & $\bar{A}$2															
A3 & $\bar{A}$3															
A4 & $\bar{A}$4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
A45& $\bar{A}$5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
$\bar{A}$6 & A1	*	>	>	>	>	*	=	<	<	<	*	>	>	>	>
$\bar{A}$6 & A2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
$\bar{A}$6 & A3	$\gtreqless$ (i)	*	*	*	*	=	*	*	*	*	$\gtreqless$ (i)	*	*	*	*
$\bar{A}$6 & A4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
$\bar{A}$6 & A5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

(i) The sign of the difference is $\geq$ for $I > p(\beta)[d_1\phi|\bar{\beta} + \psi|\beta + SC]$. The sign of the difference is $<$ for $I < p(\beta)[d_1\phi|\bar{\beta} + \psi|\beta + SC$.

CHAPTER 7
CONCLUSION

One area of concern regarding the structure of the market for accounting services is the restriction of the flow of information by solicitation bans within the profession. Currently, some state boards have ethical rules of conduct allowing direct uninvited solicitation while others ban it.

Several questions are addressed by modeling the decisions of the client, incumbent audit firm and two entrant audit firms in both the market in which direct uninvited solicitation is allowed (the allowed market) and the market in which direct uninvited solicitation is banned (the banned market). These include the following:

1. Do audit fees differ when direct uninvited solicitation is banned as compared to allowed?
2. Do the resources expended to produce audits differ when direct uninvited solicitation is banned as compared to allowed?
3. Do audit firm profits and client costs differ when direct uninvited solicitation is banned as compared to allowed?

Fee, resource expenditure and profit outcomes are derived for the banned and allowed markets by modeling the economic decisions of the client, the incumbent, and entrants. The economic decisions modeled include the client's decision to search for audit fee information, the client's decision to switch audit firms, the incumbent audit firm's pricing decisions, entrant audit firms' bidding decisions and the client's decision to invite an entrant or entrants to bid when direct uninvited solicitation is banned.

The primary results of the study relate to fee differences. The policy of banning direct uninvited solicitation creates differences in fees only when the incumbent's profit-maximizing decision is to set fees at a no-invitation level when direct uninvited solicitation is banned. Testable hypotheses are suggested regarding the relationship between direct uninvited solicitation bans and fee differences. Empirically testable hypotheses are as follows:

1. When switching occurs in both the banned and allowed markets, differences in period 0 fees , fees in periods subsequent to period 0 and the sum of period 0 fees and discounted fees in periods subsequent to period 0 do not depend upon the policy of banning or allowing direct uninvited solicitation.

2. a. When switching occurs in the allowed market and invitation does not occur in the banned market, fees in the banned market are higher than fees in the allowed market in the period of switching.

   b. When switching occurs in the allowed market and invitation does not occur in the banned market, fees differ between the banned and allowed markets in periods subsequent to switching.

   c. When switching occurs in the allowed market and invitation does not occur in the banned market, total fees (the sum of the period 0 fee and discounted period $1,\ldots,\infty$ fees) are higher in the banned market than in the allowed market.

3. When switching does not occur in the allowed market and invitation does not occur in the banned market, fees differ between the banned and allowed markets in every period.

Both an entrant uncertainty and an entrant certainty model are derived. A client's search for fee information is shown to occur only when entrants are uncertain of their efficiency relative to the incumbent's efficiency.

This research contributes to the body of economic literature which examines the relationship between consumer knowledge of the prices of goods and the structure of markets for consumer goods. When the assumption of perfect consumer information is removed, theoretical and empirical research indicates that prices are higher and more dispersed. In contrast, results of this study indicate that in the audit market, fees in the banned market may be higher, lower or equal to fees in the allowed market.

APPENDIX A
TABLES OF FEE, PROFIT AND RESOURCE EXPENDITURE OUTCOMES UNDER THE ALLOWED MARKET STRUCTURE AND THE BANNED AUDIT MARKET STRUCTURE

Table A-1
Fee, Profit and Resource Expenditure Outcomes for A1(θ_2)

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + S - d_7S^*$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + S$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + d_2F_1^E = d_1C^I - d_1\rho_i + S^* + \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = -d_7S^* - G$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = -G$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-2

Fee, Profit and Resource Expenditure Outcomes for A1(θ_3)

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + \alpha j + d_{10}S^* - SW$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S^*$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = \alpha j - d_7S^* - G - \varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\alpha j - G - \varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-3
Fee, Profit and Resource Expenditure Outcomes for A1(θ_4)

1 Period 0 Fee	$B_1^{E*} = C^I + d_2\rho_i - d_2\alpha_j - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha_j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + d_2F_1^E = d_1C^I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = d_1\rho_i - d_2\alpha_j - S^* - d_7S^* - G - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha_j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - G - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-4
Fee, Profit and Resource Expenditure Outcomes for A1(θ_5)

1 Period 0 Fee	$B_1^{E*} = C^I - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + d_2F_1^E = d_1C^I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = \rho_i - d_7S^* - S^* - G - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\rho_i + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - G - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-5
Fee, Profit and Resource Expenditure Outcomes for A2(θ_1)

1 Period 0 Fee	$F^{I^*} = C^I - \rho_i + d_{10}S^*$
2 Fee in Periods 1,...,∞	$F^I = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I^*} + d_2F^I = d_1C^I - d_1\rho_i + S^*$
4 Resources Expended By Incumbent:	
a. Production Costs in Period 0	C^I
b. Production Costs in Each Period 1,...,∞	C^I
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5 Resources Expended By Entrant 1	nG
6 Non-Fee Client Costs	None
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + d_2F^I = d_1C^I - d_1\rho_i + S^*$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + nG$
9 Incumbent's Period 0 Profit (1 - 4a - 4c)	$F^{I^*} - C^I = -\rho_i + d_{10}S^*$
10 Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I^*} - C^I) = -d_2\rho_i + d_7S^*$
11 Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I) = -d_1\rho_i + S^*$
12 Entrant 1's Profits in Period 0	-G
13 Entrant 1's Profits in Periods 1,...,∞	None

Table A-6
Fee, Profit and Resource Expenditure Outcomes for A3

1	Period 0 Fee	$F^{I}_{\bar\sigma A} = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}]-d_{10}\varepsilon$
2	Fee in Periods 1,...,∞	$F^{I}_{\bar\sigma A} = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}]-d_{10}\varepsilon$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$d_1F^{I}_{\bar\sigma A} = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}-\varepsilon$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5	Resources Expended By Entrant 1	None
6	Non-Fee Client Costs	None
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1F^{I}_{\bar\sigma A} = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}-\varepsilon$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	d_1C^I
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I}_{\bar\sigma A}-C^I = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}]$ $-d_{10}\varepsilon-C^I$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I}_{\bar\sigma A}-C^I)=d_7[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}]$ $-d_7\varepsilon-d_2C^I$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$d_1(F^{I}_{\bar\sigma A}-C^I) = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\mathbf{K}^{C}_{\bar\beta A}$ $-\varepsilon-d_1C^I$
12	Entrant 1's Profits in Periods 0,...,∞	None

Table A-7
Fee, Profit and Resource Expenditure Outcomes for A4(θ_1)

1 Period 0 Fee	$F^{I*} = C^I - \rho_i + d_{10}S^*$
2 Fee in Periods 1,...,∞	$F^I = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I*} + d_2F^I = d_1C^I - d_1\rho_i + S^*$
4 Resources Expended By Incumbent:	
a. Production Costs in Period 0	C^I
b. Production Costs in Each Period 1,...,∞	C^I
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5 Resources Expended By Entrant 1	None
6 Non-Fee Client Costs	SC
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I*} + SC + d_2F^I = d_1C^I - d_1\rho_i + S^* + SC$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + SC$
9 Incumbent's Period 0 Profit (1 - 4a)	$F^{I*} - C^I = -\rho_i + d_{10}S^*$
10 Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^I - C^I) = -d_2\rho_i + d_7S^*$
11 Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I*} - C^I + d_2(F^I - C^I) = -d_1\rho_i + S^*$
12 Entrant 1's Profits in Period 0	None
13 Entrant 1's Profits in Periods 1,...,∞	None

Table A-8
Fee, Profit and Resource Expenditure Outcomes for A5(θ_2)

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + S - d_7 S^*$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + d_{10} S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2 F_1^E = d_1 C^I - d_1 \rho_i + S$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1 C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW + SC
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + d_2 F_1^E = d_1 C^I - d_1 \rho_i + SC + S^* + \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1 C_1^E + S + SW + SC$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = -d_7 S^*$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_7 S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E)$ = None
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-9
Fee, Profit and Resource Expenditure Outcomes for A5(θ_3)

1	Period 0 Fee	$B_1^{E*} = C^I - \rho_i + \alpha j + d_{10}S^* - SW$
2	Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S - \varepsilon$
4	Resources Expended By Entrants:	
	a. Production Costs in Period 0	$C_1^E + S$
	b. Production Costs in Each Period 1,...,∞	C_1^E
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
	d. Other Period 0 Costs	None
5	Resources Expended By Incumbent	None
6	Non-Fee Client Costs	$SW + SC$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S^* + SC$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC$
9	Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = \alpha j - d_7S^* - \varepsilon$
10	Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11	Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1\alpha j - \varepsilon$
12	Incumbent's Profits in Periods 0,...,∞	None

Table A-10
Fee, Profit and Resource Expenditure Outcomes for A5(θ_4)

1 Period 0 Fee	$B_1^{E*} = C^I + d_2\rho_i - d_2\alpha j - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW + SC
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + d_2F_1^E = d_1C^I + SC - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = d_1\rho_i - d_2\alpha j - S^* - d_7S^* - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-11

Fee, Profit and Resource Expenditure Outcomes for A5(θ_5)

1 Period 0 Fee	$B_1^{E*} = C^I - d_7 S^* \text{-} SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I + d_{10} S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2 F_1^E = d_1 C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1 C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW + SC
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + d_2 F_1^E = d_1 C^I + SC - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1 C_1^E + S + SW + SC$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = \rho_i - d_7 S^* - S^* - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2 \rho_i + d_7 S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1 \rho_i \text{-} S^* \text{-} 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-12
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}1\,(\theta_2)$

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + S - d_7S^*$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees $[1 + d_2(2)]$	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + S$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ $(4a + d_24b)$	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	SW + I
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + I + d_2F_1^E = d_1C^I - d_1\rho_i + S^* + \varepsilon + I$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + I + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = -d_7S^* - G$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ $d_2(2 - 4b)$	$d_2(F_1^E - C_1^E) = d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = -G$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-13
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}1$ (θ_3)

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + \alpha j + d_{10}S^* - SW$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + I + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S^* + I$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + I + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = \alpha j - d_7S^* - G - \varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\alpha j - G - \varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-14
Fee, Profit and Resource Expenditure Outcomes for Â1 (θ_4)

1 Period 0 Fee	$B_1^{E*} = C^I + d_2\rho_i - d_2\alpha j - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + I + d_2F_1^E = d_1C^I + I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + I + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = d_1\rho_i - d_2\alpha j - S^* - d_7S^* - G - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - G - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-15
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}1$ (θ_5)

1 Period 0 Fee	$B_1^{E*} = C^I - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	nG
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + I + d_2F_1^E = d_1C^I + I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + I + nG$
9 Entrant 1's Period 0 Profit (1 - 4a - G)	$B_1^{E*} - C_1^E - S - G = \rho_i - d_7S^* - S^* - G - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\rho_i + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S - G + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - G - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-16
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}2(\theta_1)$

1 Period 0 Fee	$F^{I^*} = C^I - \rho_i + d_{10}S^*$
2 Fee in Periods 1,...,∞	$F^I = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I^*} + d_2F^I = d_1C^I - d_1\rho_i + S^*$
4 Resources Expended By Incumbent:	
a. Production Costs in Period 0	C^I
b. Production Costs in Each Period 1,...,∞	C^I
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5 Resources Expended By Entrant 1	nG
6 Non-Fee Client Costs	I
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + I + d_2F^I = d_1C^I - d_1\rho_i + S^* + I$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + nG + I$
9 Incumbent's Period 0 Profit (1 - 4a - 4c)	$F^{I^*} - C^I = -\rho_i + d_{10}S^*$
10 Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I^*} - C^I) = -d_2\rho_i + d_7S^*$
11 Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I) = -d_1\rho_i + S^*$
12 Entrant 1's Profits in Period 0	$-G$
13 Entrant 1's Profits in Periods 1,...,∞	None

Table A-17
Fee, Profit and Resource Expenditure Outcomes for Ā3

1	Period 0 Fee	$F^{I}_{\bar\sigma\bar A} = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A}]-d_{10}\varepsilon$
2	Fee in Periods 1,...,∞	$F^{I}_{\bar\sigma\bar A} = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A}]-d_{10}\varepsilon$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$d_1F^{I}_{\bar\sigma\bar A} = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A} - \varepsilon$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^{I}
	b. Production Costs in Each Period 1,...,∞	C^{I}
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^{I}
5	Resources Expended By Entrant 1	None
6	Non-Fee Client Costs	None
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1F^{I}_{\bar\sigma\bar A} = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A} - \varepsilon$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	d_1C^{I}
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I}_{\bar\sigma\bar A} - C^{I} = d_{10}[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A}]$ $-d_{10}\varepsilon - C^{I}$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I}_{\bar\sigma\bar A} - C^{I}) = d_7[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A}]$ $-d_7\varepsilon - d_2C^{I}$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$d_1(F^{I}_{\bar\sigma\bar A} - C^{I}) = \mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar\beta}\,\alpha+\mathbf{P}^{*T}_{\theta\vert\bar\beta}\,\mathbf{K}^{C}_{\bar\beta\bar A}$ $- \varepsilon - d_1C^{I}$
12	Entrant 1's Profits in Periods 0,...,∞	None

Table A-18
Fee, Profit and Resource Expenditure Outcomes for $\tilde{A}4(\theta_1)$

1	Period 0 Fee	$F^{I^*} = C^I - \rho_i + d_{10}S^*$
2	Fee in Periods 1,...,∞	$F^I = C^I - \rho_i + d_{10}S^*$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$F^{I^*} + d_2F^I = d_1C^I - d_1\rho_i + S^*$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^I
	b. Production Costs in Each Period 1,...,∞	C^I
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^I
5	Resources Expended By Entrant 1	None
6	Non-Fee Client Costs	$SC + I$
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$F^{I^*} + SC + I + d_2F^I = d_1C^I - d_1\rho_i + S^* + SC + I$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	$d_1C^I + SC + I$
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I^*} - C^I = -\rho_i + d_{10}S^*$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^I - C^I) = -d_2\rho_i + d_7S^*$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$F^{I^*} - C^I + d_2(F^I - C^I) = -d_1\rho_i + S^*$
12	Entrant 1's Profits in Period 0	None
13	Entrant 1's Profits in Periods 1,...,∞	None

Table A-19
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}5(\theta_2)$

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + S - d_7S^*$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2 F_1^E = d_1C^I - d_1\rho_i + S$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + SC + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + I + d_2F_1^E = d_1C^I - d_1\rho_i + SC + S^* + \varepsilon + I$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC + I$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = -d_7S^*$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E)$ = None
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-20
Fee, Profit and Resource Expenditure Outcomes for $\tilde{A}5(\theta_3)$

1 Period 0 Fee	$B_1^{E*} = C^I - \rho_i + \alpha j + d_{10}S^* - SW$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - d_1\rho_i + d_1\alpha j + S - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + SC + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + I + d_2F_1^E = d_1C^I - d_1\rho_i$ $+ d_1\alpha j + S^* + SC + I$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC + I$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = \alpha j - d_7S^* - \varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1\alpha j - \varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-21
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}5(\theta_4)$

1 Period 0 Fee	$B_1^{E*} = C^I + d_2\rho_i - d_2\alpha j - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I - \rho_i + \alpha j + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + SC + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + I + d_2F_1^E = d_1C^I + SC + I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC + I$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = d_1\rho_i - d_2\alpha j - S^* - d_7S^* - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\alpha j + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-22
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}5(\theta_5)$

1 Period 0 Fee	$B_1^{E*} = C^I - d_7S^* - SW - \varepsilon$
2 Fee in Periods 1,...,∞	$F_1^E = C^I + d_{10}S^*$
3 Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$B_1^{E*} + d_2F_1^E = d_1C^I - SW - \varepsilon$
4 Resources Expended By Entrants:	
a. Production Costs in Period 0	$C_1^E + S$
b. Production Costs in Each Period 1,...,∞	C_1^E
c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	$d_1C_1^E + S$
d. Other Period 0 Costs	None
5 Resources Expended By Incumbent	None
6 Non-Fee Client Costs	$SW + SC + I$
7 Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$B_1^{E*} + SW + SC + I + d_2F_1^E = d_1C^I + SC + I - \varepsilon$
8 Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 4d + 5 + 6)	$d_1C_1^E + S + SW + SC + I$
9 Entrant 1's Period 0 Profit (1 - 4a)	$B_1^{E*} - C_1^E - S = \rho_i - d_7S^* - S^* - 2\varepsilon$
10 Discounted Sum of Entrant 1's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F_1^E - C_1^E) = d_2\rho_i + d_7S^*$
11 Discounted Sum of Entrant 1's Profits in Periods 0,...,∞ (9 + 10)	$B_1^{E*} - C_1^E - S + d_2(F_1^E - C_1^E) = d_1\rho_i - S^* - 2\varepsilon$
12 Incumbent's Profits in Periods 0,...,∞	None

Table A-23
Fee, Profit and Resource Expenditure Outcomes for $\bar{A}6$

1	Period 0 Fee	$F^{I}_{\iota} = d_{10}[p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]-d_{10}\varepsilon$
2	Fee in Periods 1,...,∞	$F^{I}_{\iota} = d_{10}[p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]-d_{10}\varepsilon$
3	Sum of Period 0 Fee and Discounted Future Fees [1 + d_2(2)]	$d_1F^{I}_{\iota} = p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}] - \varepsilon$
4	Resources Expended By Incumbent:	
	a. Production Costs in Period 0	C^{I}
	b. Production Costs in Each Period 1,...,∞	C^{I}
	c. Discounted Sum of Production Costs in Periods 0,...,∞ (4a + $d_2$4b)	d_1C^{I}
5	Resources Expended By Entrant 1	None
6	Non-Fee Client Costs	None
7	Discounted Sum of Client Costs in Periods 0,...,∞ (3 + 6)	$d_1F^{I}_{\iota} = p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}] -\varepsilon$
8	Discounted Sum of Total Resources Expended in Periods 0,...,∞ (4c + 5 + 6)	d_1C^{I}
9	Incumbent's Period 0 Profit (1 - 4a)	$F^{I}_{\iota} - C^{I} = d_{10}[p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]$ $- d_{10}\varepsilon - C^{I}$
10	Discounted Sum of Incumbent's Profits in Periods 1,...,∞ d_2(2 - 4b)	$d_2(F^{I}_{\iota}-C^{I})= d_7[p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]$ $- d_7\varepsilon - C^{I}$
11	Discounted Sum of Incumbent's Profits in Periods 0,...,∞ (9 + 10)	$d_1(F^{I}_{\iota} -C^{I}) = p(\beta)[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\beta}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\beta}\alpha+\mathbf{P}^{*T}_{\theta\vert\beta}\mathbf{K}^{C}_{\beta\bar{A}}]$ $+ p(\bar{\beta})[\mathbf{A}^{CT}\mathbf{P}_{\theta\vert\bar{\beta}}\rho+\mathbf{B}^{CT}\mathbf{Q}_{\theta\vert\bar{\beta}}\alpha +\mathbf{P}^{*T}_{\theta\vert\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}]$ $- \varepsilon - d_1C^{I}$
12	Entrant 1's Profits in Periods 0,...,∞	None

APPENDIX B
MATHEMATICAL APPENDIX TO CHAPTER 6

This appendix describes derivations of results described in Chapter 6. Each derivation is described in a separate section which is referenced in the main body of the paper.

B.1 Derivation of the No-Search Condition as Described in (6.5)

The original statement of condition (ii) as described in (6.4) is

$$\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}A} - \varepsilon - d_1 C^{I} \geq 0. \qquad \text{(B.1.1)}$$

Adding $-d_1 E(\rho|\bar{\beta}) + [d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho$ to the left-hand side, substituting for $\mathbf{A}^{CT}$ from equation (5.2) and substituting for $\mathbf{P}^{*T}_{\theta|\bar{\beta}}$ and $\mathbf{K}^{C}_{\bar{\beta}A}$ from equations (5.8) and (5.9), (B.1.1) is written as

$$-d_1 E(\rho|\bar{\beta}) + [d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho + [-d_1\ -d_1\ -d_1\ 0\ \ 0]\mathbf{P}_{\theta|\bar{\beta}}\rho$$

$$+ \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + d_1 C^{I} + SC + S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}}$$

$$- \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon - d_1 C^{I} \geq 0.$$

Rearrangement of terms yields

$$-d_1 E(\rho|\bar{\beta}) + [\,0\ \ 0\ \ 0\ \ d_1\ d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + SC$$

$$+ S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon \geq 0 \qquad \text{(B.1.2)}$$

Substituting non-matrix notation for $\mathbf{P}_{\theta|\bar{\beta}}$, ρ, $+\mathbf{B}^{CT}$, $\mathbf{Q}_{\theta|\bar{\beta}}$ and α (B.1.2) is written as

$$-d_1 E(\rho|\overline{\beta}) + d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\overline{\beta})(\rho_i) + d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\overline{\beta})(\rho_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\overline{\beta})\alpha_j + SC + S^*(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon \geq 0 \qquad (B.1.3)$$

As ρ is always greater than $d_{10}\,(S^*+\varepsilon)$ for $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$, let $\rho_i = d_{10}(S^*+\varepsilon) + z_i$ where $z_i > 0$ and substitute $d_{10}(S^*+\varepsilon) + z_i$ for ρ_i in (B.1.3). (B.1.3) is rewritten as

$$d_1\, E(\rho|\overline{\beta}) \leq d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\overline{\beta})[d_{10}(S^*+\varepsilon)+z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\overline{\beta})[d_{10}(S^*+\varepsilon)+z_i] + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\overline{\beta})\alpha_j$$

$$+ SC + S^*(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon \qquad (B.1.4)$$

Combining terms and dividing through by d_1, (B.1.4) is rewritten as

$$E(\rho|\overline{\beta}) \leq d_{10}\, S^* + d_{10}\, SC + \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\overline{\beta})(z_i) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\overline{\beta})(z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\overline{\beta})\alpha_j - d_{10}\,\varepsilon\,(1 - P_{2|\bar{\beta}}) \qquad (B.1.5)$$

B.2 Derivation of the No-Search Condition as Described in (6.10)

Condition (i) is described in (6.11) is

$$\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\,\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\,\mathbf{K}^{I}_{\beta A} < \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\,\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\,\mathbf{K}^{C}_{\beta A} - \varepsilon - d_1 C^{I} \qquad (B.2.1)$$

Substituting for $\mathbf{A}^{IT}$ and $\mathbf{A}^{CT}$ from equations (6.8) and (5.2), respectively, and substituting non-matrix notation for $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\,\mathbf{K}^{C}_{\beta A}$ and $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\,\mathbf{K}^{I}_{\beta A}$, (B.2.1) is written as

$$[-d_1 \;\; -d_1 \;\; -d_1 \;\; 0 \;\; 0]\mathbf{P}_{\theta|\bar{\beta}}\rho - [-d_1 \;\; 0 \;\; 0 \;\; 0 \;\; 0]\mathbf{P}_{\theta|\bar{\beta}}\rho - S^{*}P_{1|\bar{\beta}}$$

$$+ \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + d_1C^{I} + SC + S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon > d_1C^{I}$$

$$= [0 \;\; -d_1 \;\; -d_1 \;\; 0 \;\; 0]\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + SC + S^{*}(P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon > 0 \qquad \text{(B.2.2)}$$

Adding $-d_1E(\rho|\bar{\beta}) + [d_1 \;\; d_1 \;\; d_1 \;\; d_1 \;\; d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho$ to the left-hand side of (B.2.2) and combining terms yields

$$-d_1E(\rho|\bar{\beta}) + [d_1 \;\; 0 \;\; 0 \;\; d_1 \;\; d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + SC + S^{*}(P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon > 0 \qquad \text{(B.2.3)}$$

Substituting non-matrix notation and rearranging terms, (B.2.3) is written as

$$d_1E(\rho|\bar{\beta}) < d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i) + d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i) + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta})\alpha_j$$

$$+ SC + S^{*}(P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon \qquad \text{(B.2.4)}$$

As ρ is always greater than $d_{10}(S^{*}+\varepsilon)$ for $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$, let $\rho_i = d_{10}(S^{*}+\varepsilon) + z_i$ where $z_i > 0$ for $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$. As ρ is always less than $d_{10}(S^{*}+\varepsilon)$ for $\rho_i \in \theta_1$, let $\rho_i = d_{10}(S^{*}+\varepsilon) - x_i$ where $x_i > 0$ for $\rho_i \in \theta_1$. (B.2.4) is rewritten as

$$d_1 E(\rho|\bar{\beta}) \le d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\bar{\beta})[d_{10}(S^{*}+\varepsilon) - x_i]$$

$$+d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j | \bar{\beta}) [d_{10}(S^* + \varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j | \bar{\beta}) [d_{10}(S^* + \varepsilon) + z_i] + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \alpha_j$$

$$+ SC + S^* (P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon$$

Combining terms and dividing through by d_1 yields the restatement of condition (i) as described in (6.12).

$$E(\rho|\bar{\beta}) < d_{10} S^* + d_{10} SC - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j | \bar{\beta}) (x_i)$$

$$+ \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j | \bar{\beta}) (z_i) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j | \bar{\beta}) (z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \alpha_j - d_{10} \varepsilon \; (1 - P_{2|\bar{\beta}}) + \varepsilon P_{1|\bar{\beta}} \qquad \text{(B.2.5)}$$

B.3 Derivation of the No-Search Condition as Described in (6.14)

Condition (i) is described in (B.2.2) above as

$$[0 \;\; -d_1 \;\; -d_1 \;\; 0 \;\; 0] \mathbf{P}_{\theta|\bar{\beta}} \rho + \mathbf{B}^{CT} \mathbf{Q}_{\theta|\bar{\beta}} \alpha + SC + S^* (P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon > 0$$

Substituting non-matrix notation and rearranging terms, condition (i) is written as

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) \rho_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \rho_i$$

$$- d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \alpha_j - S^* (P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$- \varepsilon P_{2|\bar{\beta}} + \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon \qquad \text{(B.3.1)}$$

From definitions of ρ_i and α_j described in Section 4.5, $\rho_i - \alpha_j = \gamma_{i-j}$. Combining terms, (B.3.1) is written as

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \overline{\beta}) \rho_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \overline{\beta}) \gamma_{i-j}$$

$$- S^*(P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) - \varepsilon P_{2|\bar{\beta}} + \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon \qquad (B.3.2)$$

As described in Table 4-5, ρ is always greater than d_{10} $(S^* + \varepsilon)$ for $\rho_i \in \theta_2$ and γ_{i-j} is always greater than d_{10} $(S^* + \varepsilon)$ for $\gamma_{i-j} \in \theta_3$. Let $\gamma_{i-j} = d_{10}(S^* + \varepsilon) + y_i$ where $y_i > 0$. Substitute $d_{10}(S^* + \varepsilon) + z_i$ for ρ_i and $d_{10}(S^* + \varepsilon) + y_i$ for γ_{i-j} in (B.3.2). Combining terms, (B.3.2) is rewritten as

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \overline{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \overline{\beta}) y_{i-j}$$

$$+ \varepsilon (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon \qquad (B.3.3)$$

B.4 Derivation of the No-Invitation Condition as Described in (6.18)

The statement of condition (b) as described in (6.17) is

$$p(\beta)\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\dot{A}}\right]$$

$$+p(\overline{\beta})\left[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta\bar{A}}\right] - \varepsilon - d_1 C^I \geq 0 \qquad (B.4.1)$$

Adding $- d_1 p(\beta)E(\rho|\beta) + p(\beta)[d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\beta}\,\rho - d_1 p(\overline{\beta})E(\rho|\overline{\beta}) + p(\overline{\beta})[d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho$ to the left-hand side, substituting for $\mathbf{A}^{CT}$ from equation (5.2) and substituting non-matrix notation for $\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\dot{A}}$ and $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\beta\bar{A}}$, (B.4.1) is written as

$$- d_1 p(\beta)E(\rho|\beta) + p(\beta)[d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\beta}\,\rho + p(\beta)[-d_1\ -d_1\ -d_1\ 0\ \ 0]\mathbf{P}_{\theta|\beta}\,\rho$$

$$-d_1 p(\overline{\beta})E(\rho|\overline{\beta}) + p(\overline{\beta})[d_1\ d_1\ d_1\ d_1\ d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho + p(\overline{\beta})[-d_1\ -d_1\ -d_1\ 0\ \ 0]\mathbf{P}_{\theta|\bar{\beta}}\,\rho$$

$$+ p(\beta)\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\beta)\Big[d_1C^I + I + S^*(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]$$

$$+ p(\bar\beta)\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar\beta}\alpha + p(\bar\beta)\Big[d_1C^I + I + SC + S^*(P_{1|\bar\beta} + P_{2|\bar\beta} + P_{3|\bar\beta}) + \varepsilon P_{2|\bar\beta}$$

$$- \varepsilon(P_{4|\bar\beta} + P_{5|\bar\beta})\Big] - \varepsilon \geq d_1C^I$$

Rearrangement of terms yields

$$- d_1p(\beta)E(\rho|\beta) + p(\beta)[\,0 \;\; 0 \;\; 0 \;\; d_1 \;\; d_1]\mathbf{P}_{\theta|\beta}\,\rho$$

$$-d_1p(\bar\beta)E(\rho|\bar\beta) + p(\bar\beta)[\,0 \;\; 0 \;\; 0 \;\; d_1 \;\; d_1]\mathbf{P}_{\theta|\bar\beta}\,\rho$$

$$+ p(\beta)\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\bar\beta)\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar\beta}\alpha + d_1C^I + I + p(\bar\beta)SC$$

$$+ p(\beta)\Big[S^*(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]$$

$$p(\bar\beta)\Big[\;S^*(P_{1|\bar\beta} + P_{2|\bar\beta} + P_{3|\bar\beta}) + \varepsilon P_{2|\bar\beta} - \varepsilon(P_{4|\bar\beta} + P_{5|\bar\beta})\Big] - \varepsilon \geq d_1C^I \qquad \text{(B.4.2)}$$

Substituting non-matrix notation, (B.4.2) is written as

$$- d_1p(\beta)E(\rho|\beta)+p(\beta)\Big[\,d_1\sum_{\rho_i\in\theta_4}\sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\beta)(\rho_i) + d_1\sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\beta)(\rho_i)\Big]$$

$$-d_1p(\bar\beta)E(\rho|\bar\beta) + p(\bar\beta)\Big[\,d_1\sum_{\rho_i\in\theta_4}\sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\bar\beta)(\rho_i) + d_1\sum_{\rho_i\in\theta_5}\sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\bar\beta)(\rho_i)\Big]$$

$$+ p(\beta)\Big[d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)\alpha_j\Big] + p(\bar\beta)\Big[d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\bar\beta)\alpha_j\Big]$$

$$+ d_1C^I + I + p(\bar\beta)SC$$

$$+ p(\beta)\Big[S^*(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]$$

$$+ p(\bar\beta)\Big[\;S^*(P_{1|\bar\beta} + P_{2|\bar\beta} + P_{3|\bar\beta}) + \varepsilon P_{2|\bar\beta} - \varepsilon(P_{4|\bar\beta} + P_{5|\bar\beta})\Big] - \varepsilon \geq d_1C^I \qquad \text{(B.4.3)}$$

Combining terms, (B.4.3) is written as

$$- d_1 E(\rho) + d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)(\rho_i) + d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)(\rho_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)\alpha_j + I + p(\beta)SC$$

$$+ S^*(P_1 + P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5)] - \varepsilon \geq 0 \qquad (B.4.4)$$

As ρ is always greater than $d_{10}\,(S^*+\varepsilon)$ for $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$, let $\rho_i = d_{10}(S^* + \varepsilon) + z_i$ where $z_i > 0$ and substitute $d_{10}(S^*+\varepsilon) + z_i$ for ρ_i in (B.4.4). (B.4.4) is rewritten as

$$d_1 E(\rho) \leq d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)[d_{10}(S^* + \varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)[d_{10}(S^* + \varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)\alpha_j + I + p(\beta)SC$$

$$+ S^*(P_1 + P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5)] - \varepsilon \qquad (B.4.5)$$

Combining terms and dividing through by d_1, (B.4.5) is rewritten as

$$E(\rho) \leq d_{10}\, S^* + d_{10}\, p(\beta)SC + d_{10}\, I + \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i, \alpha_j)(z_i)$$

$$+ \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i, \alpha_j)(z_i) + \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j)\alpha_j - d_{10}\, \varepsilon(1 - P_2), \qquad (B.4.6)$$

as stated in (6.18).

B.5 Derivation of the No-Invitation Condition When the No-Search Condition Does Not Hold as Described in (6.26)

The statement of condition (a) as described in (6.25) is

$$p(\beta)\Big[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\Big] + p(\bar{\beta})\Big[\mathbf{A}^{IT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\bar{\beta}\bar{A}}\Big] <$$

$$p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\Big]$$

$$+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\Big] - d_1C^I - \varepsilon \qquad \text{(B.5.1)}$$

Substituting for $\mathbf{A}^{IT}$ from equation (6.8),substituting for $\mathbf{A}^{CT}$ from equation (5.2), substituting non-matrix notation for $\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}$, $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{I}_{\bar{\beta}\bar{A}}$, $\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}$ and $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$, (B.5.1) is written as

$$p(\beta)\Big[[\,-d_1 \;\, 0 \;\, 0 \;\, 0 \;\, 0\,]\mathbf{P}_{\theta|\beta}\rho + P_{1|\beta}S^*\Big] + p(\bar{\beta})\Big[[\,-d_1 \;\, 0 \;\, 0 \;\, 0 \;\, 0\,]\mathbf{P}_{\theta|\bar{\beta}}\rho + P_{1|\bar{\beta}}S^*\Big] <$$

$$p(\beta)\Big[[-d_1 \;\, -d_1 \;\, -d_1 \;\, 0 \;\, 0]\mathbf{P}_{\theta|\beta}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha \;\; + d_1C^I + I$$

$$+ S^*(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]$$

$$+ p(\bar{\beta})\Big[[-d_1 \;\, -d_1 \;\, -d_1 \;\, 0 \;\, 0]\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + d_1C^I + I + SC$$

$$+ S^*(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}})\Big]$$

$$- d_1C^I - \varepsilon$$

Combining terms yields

$$p(\beta)\Big[[\,0 \;\, d_1 \;\, d_1 \;\, 0 \;\, 0\,]\mathbf{P}_{\theta|\beta}\rho\,\Big] + P_1S^* + p(\bar{\beta})\Big[[\,0 \;\, d_1 \;\, d_1 \;\, 0 \;\, 0\,]\mathbf{P}_{\theta|\bar{\beta}}\rho\,\Big] <$$

$$d_1C^I + I + S^*(P_1 + P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5)$$

$$+p(\beta)\,\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\bar{\beta})\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + p(\bar{\beta})SC - d_1C^I - \varepsilon. \qquad \text{(B.5.2)}$$

Adding $d_1p(\beta)E(\rho|\beta) + p(\beta)[-d_1 \;\, -d_1 \;\, -d_1 \;\, -d_1 \;\, -d_1]\mathbf{P}_{\theta|\beta}\,\rho + d_1p(\bar{\beta})E(\rho|\bar{\beta}) + p(\bar{\beta})[-d_1 \;\, -d_1 \;\, -d_1 \;\, -d_1 \;\, -d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho$ to the left-hand side and combining terms yields

$$d_1 p(\beta)E(\rho|\beta) + p(\beta)[-d_1\ \ -d_1\ \ -d_1\ \ -d_1\ \ -d_1]\mathbf{P}_{\theta|\beta}\,\rho + p(\beta)\Big[[\,0\ \ d_1\ \ d_1\ \ 0\ \ 0\,]\mathbf{P}_{\theta|\beta}\rho\,\Big]$$

$$+d_1 p(\bar{\beta})E(\rho|\bar{\beta}) + p(\bar{\beta})[-d_1\ \ -d_1\ \ -d_1\ \ -d_1\ \ -d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho + p(\bar{\beta})\Big[[\,0\ \ d_1\ \ d_1\ \ 0\ \ 0\,]\mathbf{P}_{\theta|\bar{\beta}}\rho\,\Big]$$

$$< I + S^*(P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5) + p(\beta)\,\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\bar{\beta})\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha$$

$$+ p(\bar{\beta})SC - \varepsilon$$

Rearrangement of terms yields

$$d_1 p(\beta)E(\rho|\beta) + p(\beta)[-d_1\ \ 0\ \ 0\ \ -d_1\ \ -d_1]\mathbf{P}_{\theta|\beta}\,\rho$$

$$+d_1 p(\bar{\beta})E(\rho|\bar{\beta}) + p(\bar{\beta})[-d_1\ \ 0\ \ 0\ \ -d_1\ \ -d_1]\mathbf{P}_{\theta|\bar{\beta}}\rho <$$

$$I + S^*(P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5) + p(\beta)\,\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\bar{\beta})\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha$$

$$+ p(\bar{\beta})SC - \varepsilon. \tag{B.5.3}$$

Substituting non-matrix notation, (B.5.3) is written as

$$d_1 p(\beta)E(\rho|\beta) + p(\beta)\Big[\,-d_1 \sum_{\rho_i\in\theta_1}\ \sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\beta)(\rho_i)$$

$$-\,d_1 \sum_{\rho_i\in\theta_4}\ \sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\beta)(\rho_i) - d_1 \sum_{\rho_i\in\theta_5}\ \sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\beta)(\rho_i)\Big]$$

$$+d_1 p(\bar{\beta})E(\rho|\bar{\beta}) + p(\bar{\beta})\Big[\,-\,d_1 \sum_{\rho_i\in\theta_1}\ \sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i)$$

$$-d_1 \sum_{\rho_i\in\theta_4}\ \sum_{\alpha_j\in\theta_4} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i) - d_1 \sum_{\rho_i\in\theta_5}\ \sum_{\alpha_j\in\theta_5} p(\rho_i,\alpha_j|\bar{\beta})(\rho_i)\Big] <$$

$$I + S^*(P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5) + p(\beta)\Big[d_1 \sum_{\rho_i\in\theta_3}\ \sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)\alpha_j\,\Big]$$

$$+p(\beta)\Big[d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\beta)\alpha_j\Big] + p(\beta)SC - \varepsilon.$$

Combining terms yields

$$d_1 E(\rho) - d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j)(\rho_i) - d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j)(\rho_i)$$

$$- d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)(\rho_i) < I + S^*(P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j + p(\beta)SC - \varepsilon. \qquad (B.5.4)$$

As ρ is always greater than $d_{10}(S^*+\varepsilon)$ for $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$, let $\rho_i = d_{10}(S^*+\varepsilon) + z_i$ where $z_i > 0$ and $\rho_i \in \theta_4$ and $\rho_i \in \theta_5$. As ρ is always less than $d_{10}(S^*+\varepsilon)$ for $\rho_i \in \theta_1$, let $\rho_i = d_{10}(S^*+\varepsilon) - x_i$ where $x_i > 0$ for $\rho_i \in \theta_1$. (B.5.4) is rewritten as

$$d_1 E(\rho) < d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j)[d_{10}(S^*+\varepsilon) - x_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j)[d_{10}(S^*+\varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)[d_{10}(S^*+\varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j + I + p(\beta)SC$$

$$+ S^*(P_2 + P_3) + \varepsilon P_2 - \varepsilon(P_4 + P_5)] - \varepsilon \qquad (B.5.5)$$

Combining terms and dividing through by d_1, (B.5.5) is rewritten as

$$E(\rho) < d_{10} S^* + d_{10}\, p(\beta)SC + d_{10}\, I - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j)x_i$$

$$+\sum_{\rho_i \in \theta_4}\sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j)(z_i)+\sum_{\rho_i \in \theta_5}\sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)(z_i)$$

$$+\sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j \ - d_{10}\,\varepsilon(1-P_2) + d_{10}\,\varepsilon P_1 \qquad \text{(B.5.6)}$$

B.6 Derivation of the No-Invitation Condition When the Search Condition Holds as Described in (6.28)

Condition (a) is described in (B.5.2) as

$$p(\beta)\Big[[\,0\ d_1\ d_1\ 0\ \ 0\,]\mathbf{P}_{\theta|\beta}\rho\ \Big] + P_1S^{*}+p(\bar{\beta})\Big[[\,0\ d_1\ d_1\ 0\ \ 0\,]\mathbf{P}_{\theta|\bar{\beta}}\rho\ \Big] <$$

$$d_1C^{I} + I + S^{*}(P_1+P_2+P_3) + \varepsilon P_2 - \varepsilon(P_4+P_5)$$

$$+p(\beta)\,\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + p(\bar{\beta})\mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + p(\bar{\beta})SC - d_1C^{I} - \varepsilon. \qquad \text{(B.6.1)}$$

Substituting non-matrix notation and combining terms yields

$$d_1\sum_{\rho_i \in \theta_2}\sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j)\rho_i + d_1\sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\rho_i \ < I + S^{*}(\,P_2+P_3)$$

$$+\varepsilon P_2 - \varepsilon(P_4+P_5) + d_1\sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j + p(\bar{\beta})SC - \varepsilon$$

Rearranging and combining terms yields

$$I + p(\bar{\beta})SC > d_1\sum_{\rho_i \in \theta_2}\sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j)\rho_i + d_1\sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\gamma_{i-j}$$

$$-\ S^{*}(\,P_2+P_3) - \varepsilon P_2 + \varepsilon(P_4+P_5) + \varepsilon$$

Substituting $d_{10}(S^{*}+\varepsilon) + z_i$ for ρ_i and $d_{10}(S^{*}+\varepsilon) + y_i$ for γ_{i-j} and combining terms yields

$$I + p(\bar{\beta})SC > d_1\sum_{\rho_i \in \theta_2}\sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j)z_i \ + d_1\sum_{\rho_i \in \theta_3}\sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)y_{i-j}$$

$$+ \varepsilon(P_3 + P_4 + P_5) + \varepsilon \qquad \text{(B.6.2)}$$

as stated in (6.28).

B.7 Derivation of the No-Invitation Condition When the No-Search Condition Holds as Described in (6.31)

The statement of condition (a) as described in (6.30) is

$$p(\beta)\Big[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\Big] + p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}} - d_1 C^{I} - \varepsilon\Big]$$

$$< p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\Big]$$

$$+ p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\Big] - d_1 C^{I} - \varepsilon. \qquad \text{(B.7.1)}$$

Combining terms yields

$$p(\beta)\Big[\mathbf{A}^{IT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}\Big] + p(\bar{\beta})\Big[\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}} - d_1 C^{I} - \varepsilon\Big]$$

$$< p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\Big]$$

$$+ p(\bar{\beta})\Big[\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\Big] - d_1 C^{I} - \varepsilon. \qquad \text{(B.7.2)}$$

Substituting for $\mathbf{A}^{IT}$ from equation (6.8),substituting for $\mathbf{A}^{CT}$ from equation (5.2) and substituting non-matrix notation for $\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{I}_{\beta\bar{A}}$, $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$, $\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}$ and $\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}$, (B.7.2) is written as

$$p(\beta)\Big[[\,-d_1 \;\; 0 \;\; 0 \;\; 0 \;\; 0\,]\mathbf{P}_{\theta|\beta}\rho + P_{1|\beta}S^{*}\Big] + p(\bar{\beta})\Big[\,d_1 C^{I} + SC + S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - \varepsilon - d_1 C^{I}\Big] <$$

$$p(\beta)\Big[[-d_1 \;\; -d_1 \;\; -d_1 \;\; 0 \;\; 0]\mathbf{P}_{\theta|\beta}\,\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha \quad + d_1 C^{I} + I$$

$$+ S^{*}(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]$$

$$+ p(\overline{\beta})\Big[d_1C^I + I + SC + S^*(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}})$$

$$+ \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}})\Big] - d_1C^I - \varepsilon$$

Combining terms yields

$$p(\beta)\Big[[\,0\ d_1\ d_1\ 0\ 0\,]\mathbf{P}_{\theta|\beta}\rho\Big] - p(\overline{\beta})\varepsilon < p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha\Big] + I + p(\beta)d_1C^I$$

$$+ p(\beta)\Big[S^*(P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big] - \varepsilon$$

$$+ p(\overline{\beta})d_1C^I - d_1C^I - \varepsilon \qquad \text{(B.7.3)}$$

Substituting non-matrix notation and rearranging terms yields

$$I > p(\beta)\Big[d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta)\rho_i + d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)\gamma_{i-j}$$

$$- S^*(P_{2|\beta} + P_{3|\beta}) - \varepsilon P_{2|\beta} + \varepsilon(P_{4|\beta} + P_{5|\beta})\Big] + \varepsilon - p(\overline{\beta})\varepsilon \qquad \text{(B.7.4)}$$

Substituting $d_{10}(S^*+\varepsilon) + z_i$ for ρ_i and $d_{10}(S^*+\varepsilon) + y_i$ for γ_{i-j} and combining terms yields

$$I > p(\beta)\Big[d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta)z_i + d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)y_{i-j}$$

$$+ \varepsilon(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon\Big] \qquad \text{(B.7.5)}$$

B.8 Comparison of Condition (a) as Stated in (6.31) with Condition (b) as Stated in (6.20)

Rewriting condition (b) from (6.20) in terms of I,

$$d_{10}\, I > E(\rho) - d_{10}\, S^* - p(\overline{\beta})\, d_{10}\, SC - \lambda$$

Dividing through by d_{10} yields

$$I > d_1 E(\rho) - S^* - p(\bar{\beta})SC - d_1\lambda \tag{B.8.1}$$

Condition (a), from (6.31) is

$$I > p(\beta)\Big[d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta) y_{i-j}$$

$$+ \varepsilon (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon\Big] \tag{B.8.2}$$

Condition (a) is stronger than condition (b) if the right-hand side of condition (a) exceeds the right-hand side of condition (b), i.e.,

$$p(\beta)\Big[d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta) y_{i-j}$$

$$+ \varepsilon (P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon\Big] > d_1 E(\rho) - S^* - p(\bar{\beta})SC - d_1\lambda \tag{B.8.3}$$

Condition (a) is derived assuming that the no-search condition holds. The no-search condition as stated in (6.14) is

$$SC > d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) y_{i-j}$$

$$+ \varepsilon (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon. \tag{B.8.4}$$

Let

$$SC = d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) y_{i-j}$$

$$+ \varepsilon (P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon + \big[SC^+\big] \tag{B.8.5}$$

Substituting for SC from (B.8.5) and for λ from (6.19) into (B.8.3) yields

$$\begin{aligned}
&p(\beta)\Big[\, d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\beta) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\beta) y_{i-j} \\
&\qquad + \varepsilon\,(P_{3|\beta} + P_{4|\beta} + P_{5|\beta}) + \varepsilon \Big] > d_1 E(\rho) - S^* \\
&\qquad - p(\bar{\beta})\Big[d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\bar{\beta}) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta}) y_{i-j} \\
&\qquad + \varepsilon\,(P_{3|\bar{\beta}} + P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) + \varepsilon + \big[SC^+\big]\Big] \\
&\qquad - d_1\Big[\sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j)(z_j) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)(z_j) \\
&\qquad + \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j - d_{10}\,\varepsilon\,\;(1 - P_2) \Big]
\end{aligned} \qquad \text{(B.8.6)}$$

Combining terms yields

$$\begin{aligned}
&d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j) z_i + d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j) y_{i-j} \;\; + \varepsilon\,(P_3 + P_4 + P_5) + \varepsilon \\
&\qquad > d_1 E(\rho) - S^* - d_1\Big[\sum_{\rho_i \in \theta_4} \sum_{\alpha_j \in \theta_4} p(\rho_i,\alpha_j)(z_j) + \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)(z_j) \\
&\qquad + \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j)\alpha_j - d_{10}\,\varepsilon\,\;(1 - P_2) \Big] + \;\; p(\bar{\beta})\big[SC^+\big]
\end{aligned} \qquad \text{(B.8.7)}$$

Substituting

$$d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j)(\rho_i) + \ldots + d_1 \sum_{\rho_i \in \theta_5} \sum_{\alpha_j \in \theta_5} p(\rho_i,\alpha_j)(\rho_i) \text{ for } \; d_1 E(\rho),$$

$d_{10}(S^* + \varepsilon) + z_i$ for ρ_i where $\theta = \theta_2, \theta_3, \theta_4$ or θ_5 and $d_{10}(S^* + \varepsilon) + y_i$ for γ_{i-j} where $\theta = \theta_3$ and combining terms yields

$$d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(\rho_i) \leq P_1 S^* + p(\bar{\beta})\left[SC^+\right]$$

Dividing through by d_1, substituting $d_{10}(S^* + \varepsilon) - x_i$ for ρ_i and combining terms yields

$$-\sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j)(x_i - \varepsilon) \leq p(\bar{\beta})\left[SC^+\right] \tag{B.8.8}$$

As $x_i > 0$, $\left[SC^+\right] > 0$ and ε is a very small amount, (B.8.8) always holds and condition (a) is always stronger than condition (b).

B.9 Derivation of the Difference Between Period 0.....∞ Fees For $\bar{A}6$ and A3

The period 0 fee when direct uninvited solicitation is banned and invitation does not occur is $F_{\bar{\iota}}^{I}$. From equation (5.22),

$$F_{\bar{\iota}}^{I} = d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}_{\theta|\beta}^{*T}\mathbf{K}_{\beta\bar{A}}^{C}\Big]$$

$$+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}\bar{A}}^{C}\Big]\Big\}.$$

The period 0 fee under the AAM when bidding and search do not occur is $F_{\bar{\sigma}A}^{I}$. From equation (5.11),

$$F_{\bar{\sigma}A}^{I} = d_{10}\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}A}^{C}\Big] - d_{10}\varepsilon.$$

The difference between period 0,...,∞ fees for decision combinations $\bar{A}6$ and A3 is

$$\begin{aligned} F_{\bar{\iota}}^{I} - F_{\bar{\sigma}A}^{I} = d_{10}\Big\{&p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}_{\theta|\beta}^{*T}\mathbf{K}_{\beta\bar{A}}^{C}\Big] \\ &+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}\bar{A}}^{C}\Big]\Big\} - d_{10}\varepsilon \\ &- d_{10}\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}A}^{C}\Big] + d_{10}\varepsilon. \end{aligned} \tag{B.9.1}$$

Combining terms yields

$$\begin{aligned} F_{\bar{\iota}}^{I} - F_{\bar{\sigma}A}^{I} = d_{10}\Big\{&p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}_{\theta|\beta}^{*T}\mathbf{K}_{\beta\bar{A}}^{C}\Big] \\ &+p(\bar{\beta})\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha + \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}\bar{A}}^{C}\Big] \\ &-\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha - \mathbf{P}_{\theta|\bar{\beta}}^{*T}\mathbf{K}_{\bar{\beta}A}^{C}\Big\} \end{aligned}$$

$$
\begin{aligned}
&= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho + \mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha + \mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\Big] \\
&\quad -\mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\,\Big[1 - p(\bar{\beta})\Big] - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\,\Big[1 - p(\bar{\beta})\Big] \\
&\quad + p(\bar{\beta})\Big[\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\Big] - \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}A}\Big\}
\end{aligned}
$$

$$
\begin{aligned}
&= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\Big] \\
&\quad + p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\Big] \\
&\quad + p(\beta)\Big[\mathbf{P}^{*T}_{\theta|\beta}\mathbf{K}^{C}_{\beta\bar{A}}\Big] + p(\bar{\beta})\Big[\mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}\bar{A}}\Big] - \mathbf{P}^{*T}_{\theta|\bar{\beta}}\mathbf{K}^{C}_{\bar{\beta}A}\Big\}
\end{aligned}
\qquad (B.9.2)
$$

Substituting non-matrix notation for $\mathbf{K}^{C}_{\beta\bar{A}}, \mathbf{K}^{C}_{\bar{\beta}\bar{A}}$ and $\mathbf{K}^{C}_{\bar{\beta}A}$ yields

$$
\begin{aligned}
F^{I}_{\bar{\imath}} - F^{I}_{\bar{\sigma}A} &= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\Big] \\
&\quad + p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\Big] \\
&\quad + p(\beta)\Big[d_1C^{I} + I + S^{*}(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big] \\
&\quad + p(\bar{\beta})\Big[d_1C^{I} + SC + I + S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) + \varepsilon P_{2|\bar{\beta}} - \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}})\Big] \\
&\quad - d_1C^{I} - SC - S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}}) - \varepsilon P_{2|\bar{\beta}} + \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}})\Big\}.
\end{aligned}
$$

Combining terms yields

$$
\begin{aligned}
F^{I}_{\bar{\imath}} - F^{I}_{\bar{\sigma}A} &= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\Big] \\
&\quad + p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\Big] \\
&\quad + I - SC\,[1 - p(\bar{\beta})] - S^{*}(P_{1|\bar{\beta}} + P_{2|\bar{\beta}} + P_{3|\bar{\beta}})\,[1 - p(\bar{\beta})] \\
&\quad - \varepsilon P_{2|\bar{\beta}}[1 - p(\bar{\beta})] + \varepsilon(P_{4|\bar{\beta}} + P_{5|\bar{\beta}})(1 - p(\bar{\beta})) \\
&\quad + p(\beta)\Big[S^{*}(P_{1|\beta} + P_{2|\beta} + P_{3|\beta}) + \varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})\Big]\Big\}
\end{aligned}
$$

$$
\begin{aligned}
&= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\Big] \\
&\quad + p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\Big] \\
&\quad + I - SC\,[p(\beta)] - S^{*}\,[p(\beta)]\,(P_{1|\bar{\beta}} - P_{1|\beta}) \\
&\quad - S^{*}\,[p(\beta)](P_{2|\bar{\beta}} - P_{2|\beta}) - S^{*}\,[p(\beta)](P_{3|\bar{\beta}} - P_{3|\beta})
\end{aligned}
$$

$$- \varepsilon P_{2|\bar{\beta}}[p(\beta)] + \varepsilon (P_{4|\bar{\beta}} + P_{5|\bar{\beta}})[p(\beta)] + p(\beta)[\varepsilon P_{2|\beta} - \varepsilon(P_{4|\beta} + P_{5|\beta})]\Big]\Big\}$$

$$= d_{10}\Big\{p(\beta)\Big[\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho\Big]$$
$$+ p(\beta)\Big[\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha\Big]$$
$$+ I - SC\ [p(\beta)] - S^*\ [p(\beta)]\ (P_{1|\bar{\beta}} - P_{1|\beta})$$
$$- S^*\ [p(\beta)](P_{2|\bar{\beta}} - P_{2|\beta}) - S^*\ [p(\beta)](P_{3|\bar{\beta}} - P_{3|\beta})$$
$$- p(\beta)[\varepsilon P_{2|\bar{\beta}} - \varepsilon P_{2|\beta}] + [p(\beta)]\varepsilon\Big[(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - (P_{4|\beta} + P_{5|\beta})\Big]\Big\} \quad (B.9.3)$$

Substituting non-matrix notation for $\mathbf{A}^{CT}\mathbf{P}_{\theta|\beta}\rho - \mathbf{A}^{CT}\mathbf{P}_{\theta|\bar{\beta}}\rho$ and $\mathbf{B}^{CT}\mathbf{Q}_{\theta|\beta}\alpha - \mathbf{B}^{CT}\mathbf{Q}_{\theta|\bar{\beta}}\alpha$ in equation (B.9.3) yields

$$F_i^I - F_{\bar{\sigma}A}^I = d_{10}\Big\{p(\beta)\Big[-d_1\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\beta)\rho_i - d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta)\rho_i$$
$$-d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)\rho_i + d_1\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\overline{\beta})\rho_i$$
$$+d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\overline{\beta})\rho_i + d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\overline{\beta})\rho_i\Big]$$
$$+ p(\beta)\Big[d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)\alpha_j - d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\overline{\beta})\alpha_j\Big]$$
$$+ I - SC\ [p(\beta)] - S^*\ [p(\beta)]\ (P_{1|\bar{\beta}} - P_{1|\beta})$$
$$- S^*\ [p(\beta)](P_{2|\bar{\beta}} - P_{2|\beta}) - S^*\ [p(\beta)](P_{3|\bar{\beta}} - P_{3|\beta})$$
$$- p(\beta)[\varepsilon P_{2|\bar{\beta}} - \varepsilon P_{2|\beta}] + [p(\beta)]\varepsilon\Big[(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - (P_{4|\beta} + P_{5|\beta})\Big]\Big\}$$

Substituting $d_{10}(S^* + \varepsilon) - x_i$ for $\rho_i \in \theta_1$ and $d_{10}(S^* + \varepsilon) + z_i$ for $\rho_i \in \theta_2$ and $\rho_i \in \theta_3$ yields

$$F_i^I - F_{\bar{\sigma}A}^I = d_{10}\Big\{p(\beta)\Big[-d_1\sum_{\rho_i\in\theta_1}\sum_{\alpha_j\in\theta_1} p(\rho_i,\alpha_j|\beta)[d_{10}(S^* + \varepsilon) - x_i]$$
$$-d_1\sum_{\rho_i\in\theta_2}\sum_{\alpha_j\in\theta_2} p(\rho_i,\alpha_j|\beta)[d_{10}(S^* + \varepsilon) + z_i]$$
$$-d_1\sum_{\rho_i\in\theta_3}\sum_{\alpha_j\in\theta_3} p(\rho_i,\alpha_j|\beta)[d_{10}(S^* + \varepsilon) + z_i]$$

$$+d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j | \bar{\beta}) [d_{10}(S^* + \varepsilon) - x_i]$$

$$+d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) \; [d_{10}(S^* + \varepsilon) + z_i]$$

$$+d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) [d_{10}(S^* + \varepsilon) + z_i]$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta) \alpha_j - d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \alpha_j \Big]$$

$$+ I - SC\,[p(\beta)] - S^*\,[p(\beta)]\;(P_{1|\bar{\beta}} - P_{1|\beta})$$

$$- S^*\,[p(\beta)](P_{2|\bar{\beta}} - P_{2|\beta}) - S^*\,[p(\beta)](P_{3|\bar{\beta}} - P_{3|\beta})$$

$$- p(\beta)[\varepsilon P_{2|\bar{\beta}} - \varepsilon P_{2|\beta}] \; + [p(\beta)]\varepsilon \Big[(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - (P_{4|\beta} + P_{5|\beta}) \Big] \Big\}$$

Combining terms yields

$$F^{I}_{\bar{\iota}} - F^{I}_{\bar{\sigma} A} = d_{10} \Big\{ p(\beta) \Big[d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j | \beta)(x_i) \; - d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j | \bar{\beta})(x_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \bar{\beta}) \; (z_i) - d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j | \beta)(z_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta})(z_i) - \; d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta)(z_i)$$

$$- S^* \; [P_{1|\beta} - P_{1|\bar{\beta}} + P_{2|\beta} - P_{2|\bar{\beta}} + P_{3|\beta} - P_{3|\bar{\beta}}]$$

$$- \varepsilon [P_{1|\beta} - P_{1|\bar{\beta}} + P_{2|\beta} - P_{2|\bar{\beta}} + P_{3|\beta} - P_{3|\bar{\beta}}]$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \beta) \alpha_j - d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j | \bar{\beta}) \alpha_j \Big]$$

$$+ I - SC\,[p(\beta)] - S^*\,[p(\beta)]\;(P_{1|\bar{\beta}} - P_{1|\beta})$$

$$- S^*\,[p(\beta)](P_{2|\bar{\beta}} - P_{2|\beta}) - S^*\,[p(\beta)](P_{3|\bar{\beta}} - P_{3|\beta})$$

$$- p(\beta)[\varepsilon P_{2|\bar{\beta}} - \varepsilon P_{2|\beta}] \; + [p(\beta)]\varepsilon \Big[(P_{4|\bar{\beta}} + P_{5|\bar{\beta}}) - (P_{4|\beta} + P_{5|\beta}) \Big] \Big\}$$

Combining terms with S^* and ε yields

$$F_{\iota}^{!} - F_{\sigma A}^{!} = d_{10}\{p(\beta)[d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\beta)(x_i) - d_1 \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\overline{\beta})(x_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\overline{\beta})(z_i) - d_1 \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta)(z_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\overline{\beta})(z_i) - d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta)(z_i)$$

$$+ d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta)\alpha_j - d_1 \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\overline{\beta})\alpha_j$$

$$- SC + \varepsilon P_{2|\beta} - \varepsilon P_{2|\bar{\beta}}\} + d_{10}\ I$$

Combining terms yields

$$F_{\iota}^{!} - F_{\sigma A}^{!} = p(\beta)[\sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\beta)(x_i) - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\overline{\beta})(x_i)$$

$$+ \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\overline{\beta})(z_i) - \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i, \alpha_j|\beta)(z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\overline{\beta})(z_i) - \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta)(z_i)$$

$$+ \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\beta)\alpha_j - \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i, \alpha_j|\overline{\beta})\alpha_j$$

$$- d_{10} SC + d_{10}\varepsilon P_{2|\beta} - d_{10}\varepsilon P_{2|\bar{\beta}}\} + d_{10}\ I \qquad \text{(B.9.4)}$$

As $\alpha_j = \rho_i - \gamma_{i-j}$, substituting $d_{10}(S^* + \varepsilon) + z_i$ for ρ_i, $\alpha_j = d_{10}(S^* + \varepsilon) + z_i - \gamma_{i-j}$. For $\gamma_{i-j} \in \theta_3$, $\gamma_{i-j} > d_{10}(S^* + \varepsilon)$. Thus γ_{i-j} can be written as $d_{10}(S^* + \varepsilon) + y_{i-j}$ where $y_{i-j} \geq 0$. Substituting $d_{10}(S^* + \varepsilon) + z_i$ for ρ_i and $d_{10}(S^* + \varepsilon) + y_{i-j}$ for γ_{i-j},

$$\alpha_j = d_{10}(S^* + \varepsilon) + z_i - [d_{10}(S^* + \varepsilon) + y_{i-j}]$$

$$= z_i - y_{i-j}.$$

Substituting $z_i - y_{i-j}$ into (B.9.4) and combining terms yields

$$F_{\iota}^{!} - F_{\sigma A}^{!} = p(\beta)[\sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\beta)(x_i) - \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i, \alpha_j|\overline{\beta})(x_i)$$

$$+\sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\bar{\beta})\ (z_i) - \sum_{\rho_i \in \theta_2} \sum_{\alpha_j \in \theta_2} p(\rho_i,\alpha_j|\beta)(z_i)$$

$$-\sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\beta)\ y_{i-j} + \sum_{\rho_i \in \theta_3} \sum_{\alpha_j \in \theta_3} p(\rho_i,\alpha_j|\bar{\beta})\ y_{i-j}$$

$$- d_{10}\,SC + d_{10}\,\varepsilon P_{2|\beta} - d_{10}\,\varepsilon P_{2|\bar{\beta}} \Big] + d_{10}\ I \tag{B.9.5}$$

Algebraic rearrangement yields

$$F^{I}_{\bar{\iota}} - F^{I}_{\bar{\sigma}A} = -p\,(\beta)\Big[\phi|\bar{\beta} - \phi|\beta\Big] - p\,(\beta)\,d_{10}\Big[\psi|\beta - \psi|\bar{\beta}\Big]$$

$$- p\,(\beta)\,d_{10}\,SC + d_{10}\,I \tag{B.9.6}$$

where

$$\phi|\bar{\beta} = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\bar{\beta})(x_i) - d_{10}\,\varepsilon P_{1|\bar{\beta}} \text{ and}$$

$$\phi|\beta = \sum_{\rho_i \in \theta_1} \sum_{\alpha_j \in \theta_1} p(\rho_i,\alpha_j|\beta)(x_i) - d_{10}\,\varepsilon P_{1|\beta}.$$

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BIOGRAPHICAL SKETCH

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